GSE Gateway Services CSCI
Requirements and Design Review

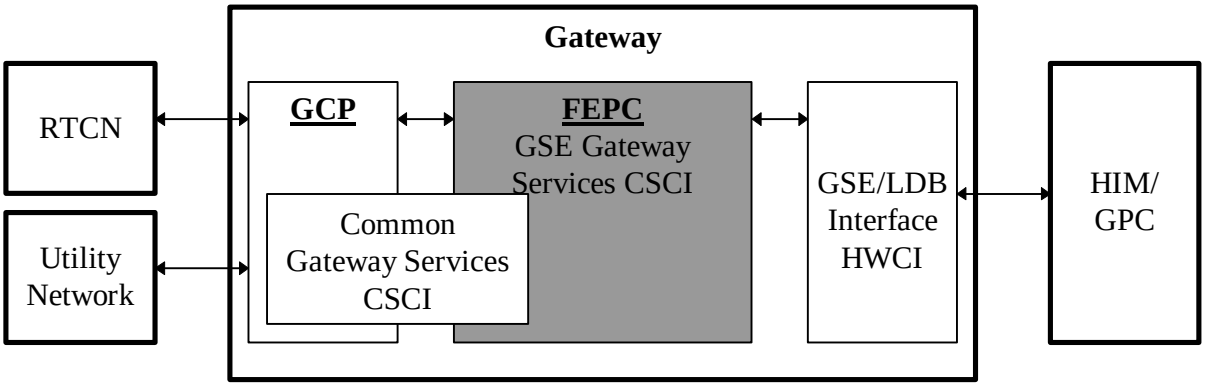
Version 2.0
Oct. 22, 1997

1. GSE Gateway Services CSCI

1.1 GSE Gateway Services Introduction

1.1.1 GSE Gateway Services Overview

The GSE Gateway Services CSCI provides the functionality required to interface to a HIM Ground Data Bus (GDB). This functionality includes the ability to issue commands to and poll measurement information from GSE HIM's. The GSE Gateway Services CSCI resides on the Front End Control Processor within the GSE gateway. The CSCI interfaces to the HIM GDB through the GSE/LDB HWCI and to the remainder of CLCS through the GCP Services API which is part of the Common Gateway Services CSCI.



1.1.2 GSE Gateway Services CSCI Groundrules

The following will not be provided in the Thor delivery

1. Redundancy / Switchover
2. Formal performance testing.
3. HIM Type II functionality.
4. CITE fuel cell simulation (It is assumed that this is no longer a requirement for CLCS)

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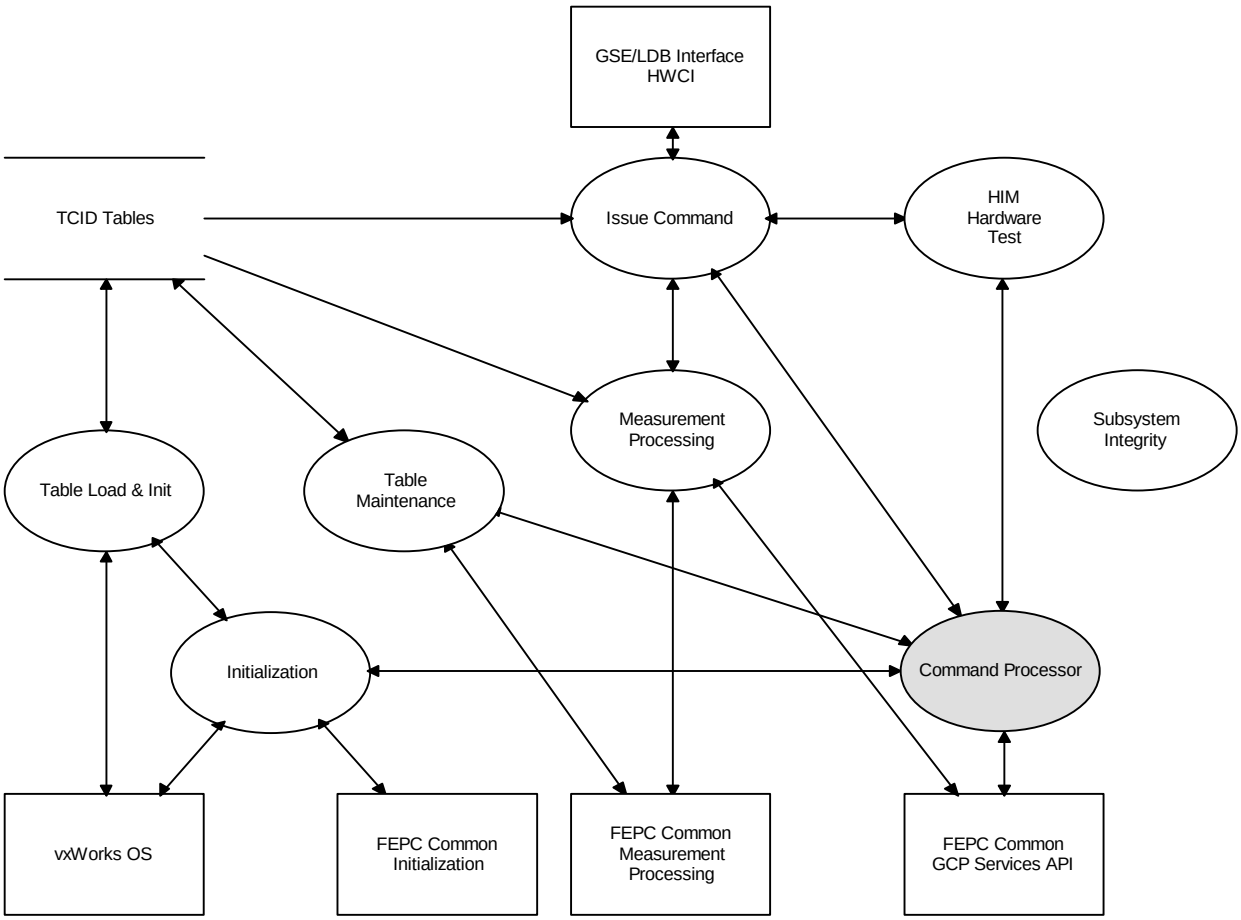
2. GSE Command Processor CSC

2.1 GSE Command Processor CSC Introduction

2.1.1 GSE Command Processor CSC Overview

The GSE Command Processor CSC is part of the GSE Gateway Services CSCI. The CSC is responsible for interpreting and controlling the execution of all commands received by the GSE Gateway Services CSCI.



2.1.2 GSE Command Processor CSC Operational Description

The GSE Command Processor CSC accepts commands from the RTCN via the GCP Services API which forms the interface to the Gateway Common Services CSCI. The GSE Command Processor CSC waits for a command using an API function call, then decodes the route code and request ID in the command header and calls the proper command function in the CSC which is responsible for executing the command. The CSC which contains the command function is responsible for generating the command response using a call to the GCP Services API. An exception to this rule is for HIM Ground Data Bus commands and memory read and alter. These commands are handled directly by this CSC.

2.2 GSE Command Processor CSC Specifications

2.2.1 GSE Command Processor CSC Groundrules

- Redundancy / switchover commands are not supported for Thor.

2.2.2 GSE Command Processor CSC Functional Requirements

1. The interface to the Gateway Common Services CSCI on the GCP will be implemented using the GCP Services API.

2. GSE Command Processor will communicate all commands and responses to the Gateway Common Services CSCI using the GCP Services API.

3. GSE Command Processor will support the following operational commands:
   - 3.1. Set (discrete FD's)
   - 3.2. Apply (analog FD's)
   - 3.3. Issue (digital pattern FD's) *(new for Thor)*
   - 3.4. Read discrete *(new for Thor)*
   - 3.5. Read analog *(new for Thor)*
   - 3.6. Read digital pattern *(new for Thor)*

4. GSE Command Processor will respond to the Set and Apply commands with the following data:
   - 4.1. IEE 754 previous value (analog only) *(new for Thor)*
   - 4.2. IEEE 754 requested value (analog only)
   - 4.3. IEEE 754 actual value (analog only)
   - 4.4. Previous output *(new for Thor)*
   - 4.5. Requested output
   - 4.6. Actual output
   - 4.7. Completion Code

5. The completion code for the set ,apply, issue and read command responses will contain one of the following:
   - 5.1. Successful
   - 5.2. Invalid FDID
   - 5.3. HIM error
   - 5.4. Verification error
   - 5.5. HIM Time-out
   - 5.6. Invalid FDID Type

6. GSE Command Processor will retry a command two additional times if an error is detected during transmission.

7. GSE Command Processor, upon completion of a command retry, will issue a system message indicating success or failure, number of retries and description of the failure.

8. GSE Command Processor will verify the new command state contained in the HIM response data.

9. GSE Command Processor will verify the state of the discretes within the discrete group that should be unaffected by a discrete command request and issue a system message for each discrete which fails the verification.

10. GSE Command Processor will output the current commanded state of all discretes within the discrete group that changed via the change data interface.

11. GSE Command Processor will be capable of generating system messages through the Gateway Common Services CSCI using the GCP Services API.

12. GSE Command Processor will be capable of requesting through the GCP Services API that a message be written to a file on the local hard drive or the local console port.

13. GSE Command Processor will process requests to dump memory.

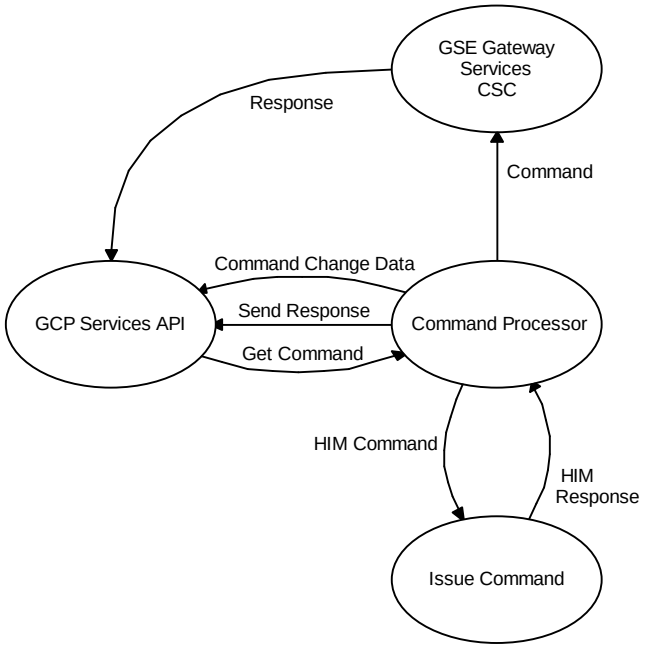
14. GSE Command Processor will process requests to alter memory.

2.2.3 GSE Command Processor CSC Performance Requirements

1. GSE Gateway Services will be capable of processing 500 uplink commands per second

2.2.4 GSE Command Processor CSC Data Flow Diagram

External Data Flow Diagram



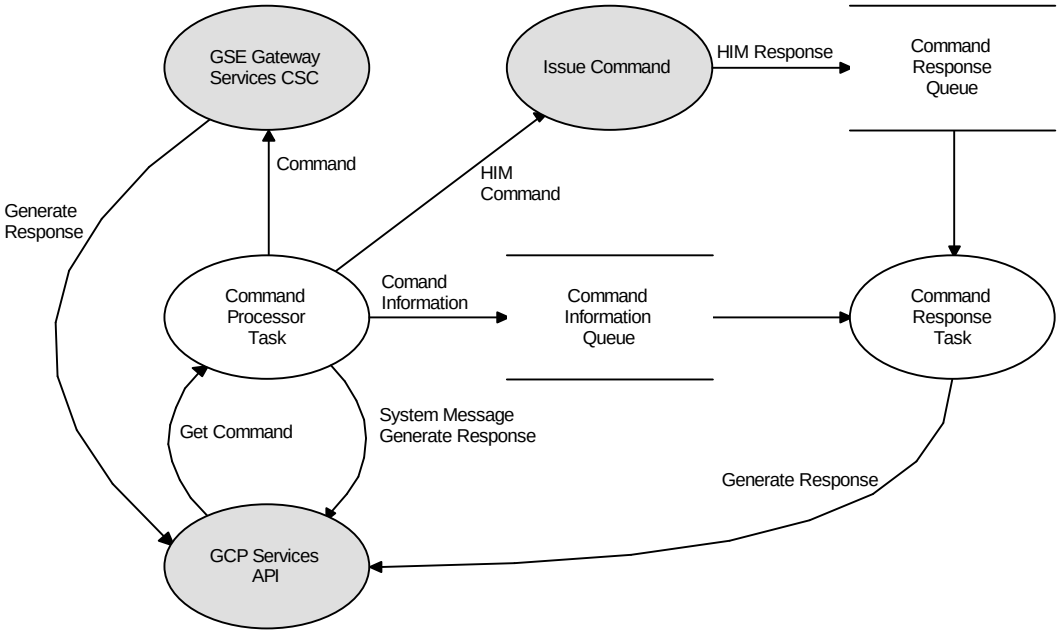
The Command Processor CSC will uses a function calls provided by the GCP Services API to receive commands and send responses via the RTCN. The Command Processor CSC will decode the route code and request ID in the command header and call the proper command function within the CSC responsible for executing the command. The CSC containing the command function is responsible for generating the command response using a call to the GCP Services API. The only exception to this rule is for HIM Ground Data Bus (GDB) commands and memory read/alter commands. These commands are directly handled by this CSC.

2.3 GSE Command Processor CSC Design Specification

The GSE Command Processor is essentially a decoder function. The CSC will decode the route code and request ID fields of the incoming command and perform a call to the appropriate function in the proper CSC to execute the command. The CSC will output a system message if the route code or request ID are not valid for the GSE gateway.

2.3.1 GSE Command Processor CSC Detailed Data Flow

Detailed Data Flow Diagram



The Command Processor Task waits for a command from the RTCN using the GCP Services API wait_command() call. When a command is received, the Command Processor Task will decode the route code and request ID and then execute the proper command function (See Section 2.3.2.1 Command Functions) within the CSC responsible for the command. The CSC containing the command function is responsible for generating the command response using a call to the GCP Services API. An exception to this rule is for HIM Ground Data Bus (GDB) commands and memory read/alter commands which are handled directly by this CSC.

If the command is a HIM GDB command, the Command Processor Task will:

- Convert FDID and data to HIM format.
- Store information pertaining to the command packet in the Command Information Queue.
- Send the command to the GSE Issue Command CSC.

The Command Response task will:

- Get the HIM response from the GSE Issue Command CSC
- Retry the command through the command processor task up to a total of two times if required due to error.
- Convert the HIM data to CLCS format
- Build the command response using information from the Command Information Queue
- Send the response using the GCP Services API send_response() call.

2.3.2 GSE Command Processor CSC External Interfaces

2.3.2.1 Command Functions

The Command Processor CSC is not directly responsible for the execution of most commands. It is a decoder process which will perform a command function call based on the route code and request id of the command. Command functions reside within the CSC responsible for the element being commanded.

The generic form of a command function call is:

void function_name(GCPS_COMMAND_INFO_PTR info, void *message_body);

Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure which contains the information defined above.
	message_body	Pointer to the body of the message

These parameters are defined in the GCP Services API CSC which is part of the Common Gateway Services CSCI.

All command functions will use the generate_response() call in the GCP Services API to send command responses. The command response task that is part of this CSC will perform the generate_response() call for those commands for which it is directly responsible.

2.3.2.2 GSE Command Processor Message Formats

2.3.2.2.1 Invalid Route Code

Message Number = 105
Message Group = _____
Severity = Warning

Invalid Route Code %d for CPU ID %d

Insert #1	integer	Route code
Insert #2	integer	CPU number

2.3.2.2.2 Invalid Request ID

Message Number = 106
Message Group = _____
Severity = Warning

Invalid Request ID %d for route code %d CPU ID %d

Insert #1	integer	Request ID
Insert #2	integer	CPU number

2.3.2.2.3 Uncommanded Discretes

Message Number = 61
Message Group = _____
Severity = Critical

Uncommanded discrete error: HIM %x Channel %x is %x should be %x

Insert #1	integer	HIM address
Insert #2	integer	HIM channel (card/function)
Insert #3	integer	Current value
Insert #4	integer	Expected value

2.3.2.2.4 Command Retry

Message Number = 65
Message Group = _____
Severity = Warning

HIM command retry required: HIM %x Channel %x Data %x Attempts %d

Insert #1	integer	HIM address
Insert #2	integer	HIM channel (card/function)
Insert #3	integer	HIM data
Insert #4	integer	Number of attempts

2.3.2.2.5 Command Failed

Message Number = 66
Message Group = _____
Severity = Warning

HIM command fail: HIM %x Channel %x Data %x Attempts %x due to GDB %s error

Insert #1	integer	HIM address
Insert #2	integer	HIM channel (card/function)
Insert #3	integer	HIM data
Insert #4	integer	Number of attempts
Insert #5	ASCII string	Error type

- HIM
- length
- parity
- manchester
- timeout

2.3.2.2.6 Invalid Gateway Mode

Message Number = 107
Message Group = _____
Severity = Informational

Invalid gateway mode for this command

COMMAND RESPONSE ONLY - This message number is defined as a completion code to a command. It should never appear as a system message.

2.3.2.2.7 Invalid FDID

Message Number = 108
Message Group = _____
Severity = Informational

FDID not valid for this gateway

COMMAND RESPONSE ONLY - This message number is defined as a completion code to a command. It should never appear as a system message.

2.3.2.2.8 Invalid Command Type

Message Number = 109
Message Group = _____
Severity = Informational

Invalid CMDT data type for command

COMMAND RESPONSE ONLY - This message number is defined as a completion code to a command. It should never appear as a system message.

2.3.2.2.9 Command Disabled

Message Number = 109
Message Group = _____
Severity = Informational

Command disabled

COMMAND RESPONSE ONLY - This message number is defined as a completion code to a command. It should never appear as a system message.

2.3.2.2.10 Command Information Queue Full

Message Number = 111
Message Group = _____
Severity = Critical

Command lost - command information queue is full

This command could not be processed because the command information queue is full.

2.3.2.2.11 Command Response Queue Timeout

Message Number = 112
Message Group = _____
Severity = Critical

Command response queue timeout - FATAL ERROR

The Command Processor CSC has detected a timeout in it's response interface to the GSE Issue Command CSC. This error can only occur if the GSE Issue Command CSC has had a fatal error.

2.3.2.2.12 Command Response Queue Sync Error

Message Number = 113
Message Group = _____
Severity = Critical

Command response queue sync error- FATAL ERROR

The command information queue and the command response queues are no longer in sync. This will not happen unless either the Command Processor CSC or the GSE Issue Command CSC has a fatal error.

2.3.2.3 GSE Command Processor CSC C-to-C Communications

2.3.2.3.1 Apply Analog

Apply floating point (FP) value to an analog output. Values are defined to be IEEE 754 single precision floating point.

Apply Analog Command (Routing Code 11, Request ID 1)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
4	Requested analog stimulus value (EU)	4	Requested value (FP)
2	Control Logic Over-ride (1 = over-ride)	4	Received value (FP)
		4	Previous value (FP)
		2	Transmitted raw counts
		2	Received raw counts
		2	Previous raw counts

Response Completion Codes:

- Successful
- Invalid FDID
- HIM error (Received raw counts contains HIM SR 1)
- HIM timeout
- FDID not analog type
- Command disabled

2.3.2.3.2 Set Discrete

Set Discrete Command (Routing Code 11, Request ID 2)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
2	Requested state (0= 0x0000, 1=0xffff)	2	Requested state (0= 0x0000, 1=0xffff)
2	Control Logic Over-ride (1 = over-ride)	2	Received state (0= 0x0000, 1=0xffff)
		2	Previous state (0= 0x0000, 1=0xffff)

Response Completion Codes:

- Successful
- Invalid FDID
- HIM error (Received state contains HIM SR 1)
- HIM timeout
- FDID not discrete type
- Verification error
- Command disabled

2.3.2.3.3 Issue Digital Pattern

Issue Digital Pattern (Routing Code 11, Request ID 3)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
2	Requested value	2	Requested value
2	Control Logic Over-ride (1 = over-ride)	2	Received value
		2	Previous value

Response Completion Codes:

- Successful
- Invalid FDID
- HIM error (Received value contains HIM SR 1)
- HIM timeout
- FDID not digital pattern type
- Command disabled

2.3.2.3.4 Read Analog

Values are defined to be IEEE 754 single precision floating point.

Read Analog (Routing Code 11, Request ID 4)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
		4	Current value (FP)
		2	Current raw counts

Response Completion Codes:

- Successful
- Invalid FDID
- HIM error (Current raw counts contains HIM SR 1)
- HIM timeout
- FDID not analog type

2.3.2.3.5 Read Discrete

Read Discrete (Routing Code 11, Request ID 5)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
		2	Current state (0= 0x0000, 1=0xffff)

Response Completion Codes:

- Successful
- Invalid FDID
- HIM error (Current state contains HIM SR 1)
- HIM timeout
- FDID not discrete type

2.3.2.3.6 Read Digital Pattern

Read Digital Pattern (Routing Code 11, Request ID 6)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
		2	Current value

Response Completion Codes:

- Successful
- Invalid FDID
- HIM error (Current value contains HIM SR 1)
- HIM timeout
- FDID not digital pattern type

2.3.2.3.7 Read Memory

Read Memory (Routing Code XX, Request ID X)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	CPU ID	4	CPU ID
4	Memory address	4	Memory address
		4	Word1
		4	Word2
		4	Word3
		4	Word4
		4	Word5
		4	Word6
		4	Word7
		4	Word8

Response Completion Codes:

- Successful
- Invalid CPU ID
- Invalid address

2.3.2.3.8 Alter Memory

Alter Memory (Routing Code 10, Request ID 1)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	CPU ID	4	CPU ID
4	Memory address	4	Memory address
4	New contents - word1	4	Old contents - word1
4	New contents - word2	4	New contents - word1
4	New contents - word3	4	Old contents - word2
4	New contents - word4	4	New contents - word2
4	New contents - word5	4	Old contents - word3
4	New contents - word6	4	New contents - word3
4	New contents - word7	4	Old contents - word4
4	New contents - word8	4	New contents - word4
		4	Old contents - word5
		4	New contents - word5
		4	Old contents - word6
		4	New contents - word6
		4	Old contents - word7
		4	New contents - word7
		4	Old contents - word8
		4	New contents - word8

Response Completion Codes:

- Successful
- Invalid CPU ID
- Invalid address

2.3.2.4 GSE Command Processor CSC External Interface Calls

None

2.3.3 GSE Command Processor CSC Test Plan

2.3.3.1 Environment

A development GSE gateway will be connected to a mini-HIM which contains a defined set of I/O cards. At least one card for each of the data types supported will be present. TCID tables which support the mini-HIM configuration will be present on the GSE gateway local hard drive. Each of the commands supported will be sent and the response verified. The action taken by the command will also be verified as part of the verification of the CSC to which the command belongs. Commands will be generated which demonstrate each of the response codes, when possible.

2.3.3.2 Test tools

The GSE gateway will be commanded using a CCP/DDP simulator test tool developed by the gateway group. This tool is capable of generating and displaying the responses of all GSE gateway commands.

2.3.3.3 Test Cases

Apply analog
Set discrete
Issue digital pattern
Read analog
Read discrete
Read digital pattern
Read memory
Alter memory

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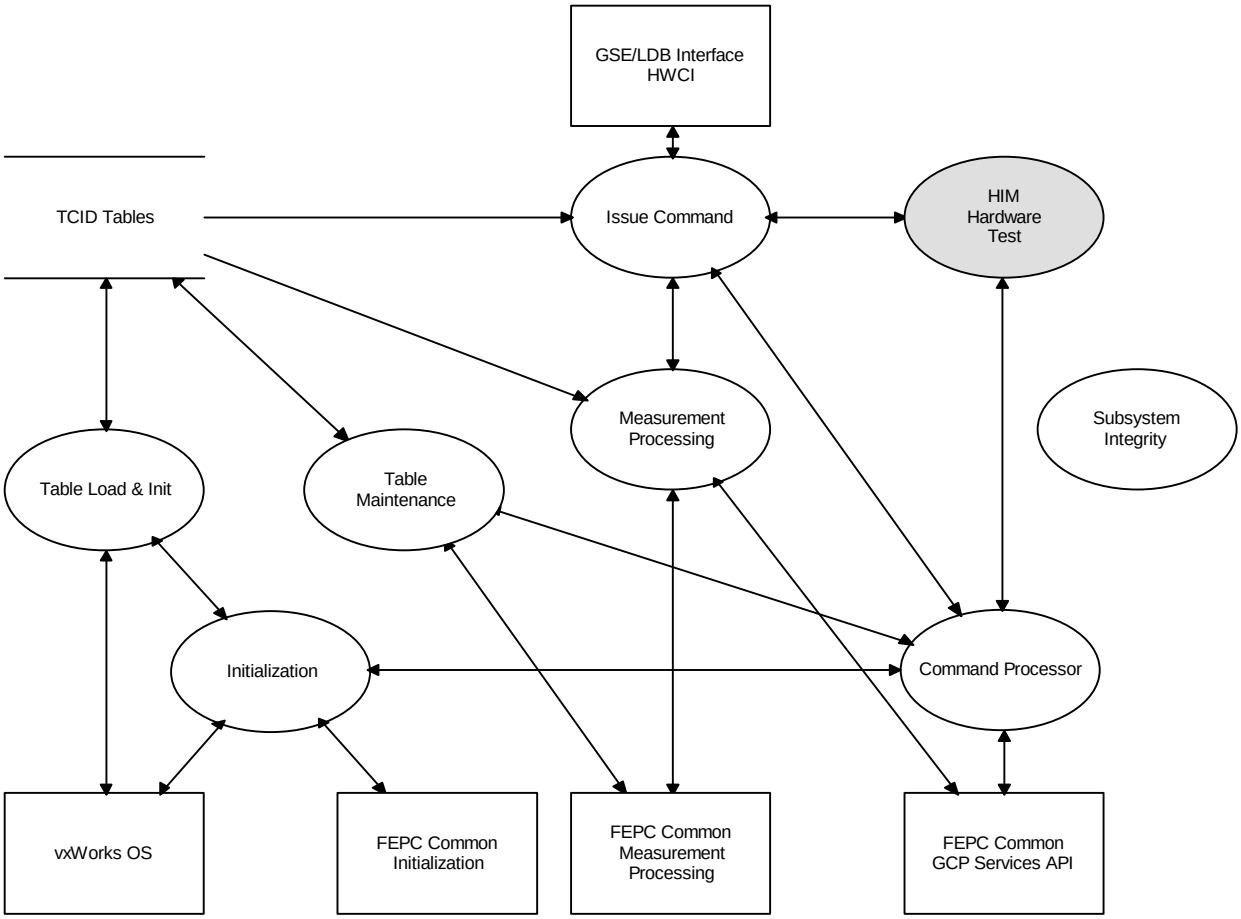
3. GSE HIM Hardware Test CSC

3.1 GSE HIM Hardware Test CSC Introduction

3.1.1 GSE HIM Hardware Test CSC Overview

The GSE HIM Hardware Test CSC is part of the GSE Gateway Services CSCI. The CSC is responsible for performing cyclic tests on each HIM being polled and on each I/O card within the HIM.



3.1.2 GSE HIM Hardware Test CSC Operational Description

The GSE Gateway HIM Hardware CSC accepts commands from the RTCN via the Command Processor CSC which forms the interface to the Gateway Common Services CSCI. These commands provide the ability to start and stop HIM test and also to inhibit and activate testing on a particular HIM or FD. HIM Hardware Test sends approximately four commands per second to the HIMs. Two of these commands are a HIM wrap test and a HIM bus test, which are cycled through all connected HIM's. The other two commands are I/O card tests which are defined as all one's and all zero's tests for discrete and digital pattern cards or 20%and 80% calibration tests for analog cards. HIM Hardware Test will also perform the HIM switch scan function where HIM command card outputs are read and compared to their expected states.

3.2 GSE HIM Hardware Test CSC Specifications

3.2.1 GSE HIM Hardware Test CSC Groundrules

1. HIM Hardware Test will incorporate the CCMS HIM switch scan functionality.

3.2.2 GSE HIM Hardware Test CSC Functional Requirements

1. GSE HIM Hardware Test will process requests to activate/inhibit global HIM hardware testing.

2. GSE HIM Hardware Test will process requests to activate/inhibit HIM hardware testing on a HIM.

3. GSE HIM Hardware Test will process requests to activate/inhibit HIM hardware testing on an FDID

4. GSE HIM Hardware Test will issue a HIM test command only when:
   - 4.1. Global command issuance is enabled
   - 4.2. Global HIM testing is enabled
   - 4.3. Data acquisition is enabled
   - 4.4. The HIM under test is active
   - 4.5. The HIM under test has HIM test active
   - 4.6. The measurement under test has HIM test active.

5. GSE HIM Hardware Test will be activated as a result of the activate data acquisition command provided HIM test has not been inhibited by a previous inhibit global HIM hardware testing command.

6. GSE HIM Hardware Test will maintain the following information and make it available to subsystem integrity and to the gateway maintenance interface:
   - 6.1. HIM test active / inhibited
   - 6.2. Low calibration test count
   - 6.3. Low calibration fail count
   - 6.4. High calibration test count
   - 6.5. High calibration fail count
   - 6.6. All zeros test count
   - 6.7. All zeros fail count
   - 6.8. All ones test count
   - 6.9. All ones fail count
   - 6.10. Wrap test count
   - 6.11. Wrap fail count
   - 6.12. Bus test count
   - 6.13. Bus test fail count

7. GSE HIM Hardware Test will maintain a list of the last 50 errors which have occurred.

8. The last 50 HIM Hardware Test errors will be made available to the gateway maintenance interface.

9. GSE HIM Hardware Test will consider an analog low calibration test successful only if the HIM response is between plus or minus 1 bit of the 20% full scale value (0x33).

10. GSE HIM Hardware Test will consider an analog high calibration test successful only if the HIM response is between plus or minus 1 bit of the 80% full scale value (0xCC).

11. GSE HIM Hardware Test will consider a HIM discrete all ones test successful only if the HIM returns all logic ones in its response.

12. GSE HIM Hardware Test will consider a HIM discrete all zeroes test successful only if the HIM returns all logic zeroes in its response.

13. GSE HIM Hardware Test will consider a HIM wrap test successful only if the exact bit pattern issued is returned by the HIM.

14. GSE HIM Hardware Test will perform the HIM switch scan function unless disabled by command.

15. The GSE HIM Hardware Test switch scan function will read HIM output status, compare the current state of each output with the current value in the CMDT and report miscompares when they occur.

16. GSE HIM Hardware Test will be capable of issuing a minimum of four HIM hardware tests per second when HIM hardware testing is active.

17. GSE HIM Hardware Test will issue a minimum of two HIM card tests per second (defined as high and low calibration tests for analogs or all ones and all zeros test for discretes and digital patterns) when HIM hardware testing is active.

18. GSE HIM Hardware Test will issue a minimum of two HIM wrap or bus test commands per second when HIM hardware testing is active.

19. GSE HIM Hardware Test will be capable of generating system messages through the Gateway Common Services CSCI using the GCP Services API.

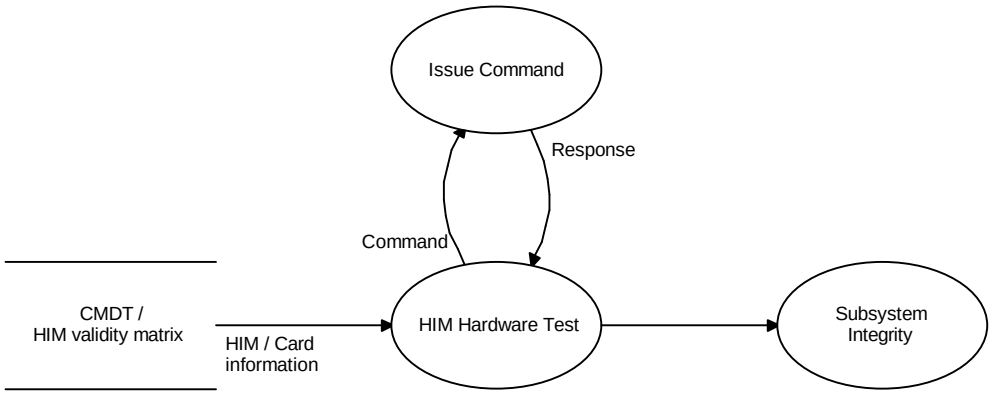
20. GSE HIM Hardware Test will be capable of requesting through the GCP Services API that a message be written to a file on the local hard drive or the local console port.

3.2.3 GSE HIM Hardware Test CSC Performance Requirements

None

3.2.4 GSE HIM Hardware Test CSC Data Flow Diagram

External Data Flow Diagram



HIM Hardware Test interfaces to the GSE Issue Command CSC, the Subsystem Integrity CSC and to local tables.

The HIM test command is sent to the GSE Issue Command CSC for output on the GDB. HIM responses are returned in a response queue created as part of the HIM Hardware Test CSC.

The HIM command to be output is determined by examining the HIM validity matrix and the CMDT.

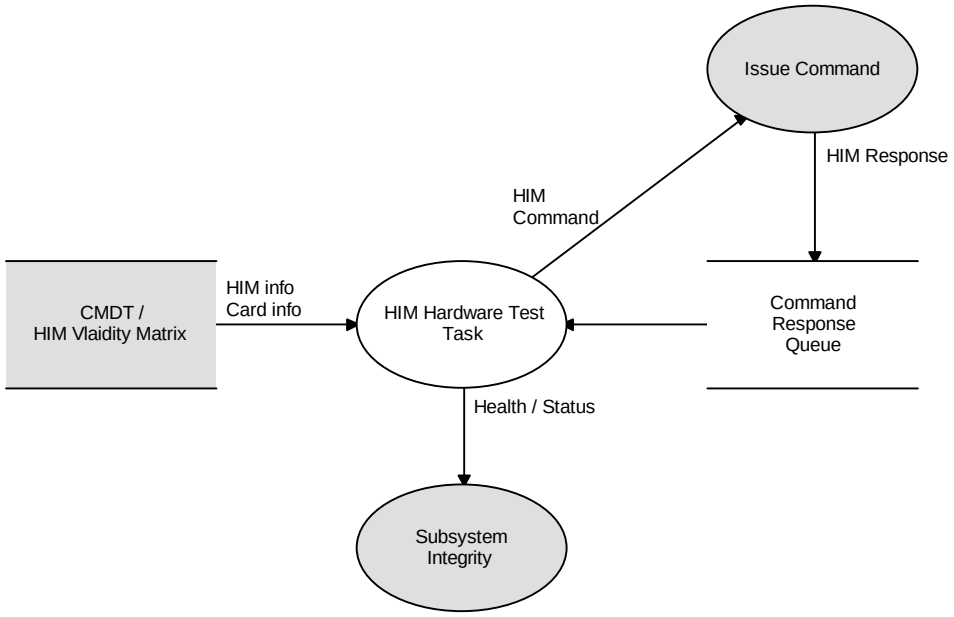
Test result status information is made available to the Subsystem Integrity CSC.

3.3 GSE HIM Hardware Test CSC Design Specification

The HIM Hardware Test CSC outputs HIM test commands and HIM card tet commands to verify the health of the GSE subsystem.

3.3.1 GSE HIM Hardware Test CSC Detailed Data Flow

Detailed Data Flow Diagram



The HIM Hardware Test CSC will output at least four commands per second. The first two commands are a HIM wrap test followed by a HIM bus test. These commands will be cycled through all active HIMs as determined by the HIM validity matrix. This rate will allow the maximum of 16 allowed HIMs to be tested once every 16 seconds.

The next two commands are HIM card specific commands. At a two per second rate, all cards will be tested approximately once every 10 minutes. The CMDT is scanned and the test commands are determined based on the data type of the CMDT entries as follows:

Data Type	HIM Command
DM, DPM	All one's test, All zero's test
AM	20% calibration, 80% calibration
DS, DPS, AS	Read command output (switch scan)

Errors detected by the HIM Hardware Test CSC will be reported using system messages. Statistics will be kept on the number of tests attempted and the number of failures that occurred. These statistics will be made available to Subsystem Integrity

.

The HIM Hardware Test CSC will provide command functions to activate / inhibit testing globally, on a specified HIM or on a specified FDID. The global activate/inhibit HIM test command will provide separately enable options for normal HIM test, switch scan or both.

HIM hardware testing will become active as part of processing the activate data acquisition (A DA) command unless it has been inhibited prior to the A DA.

The following HIM hardware test commands will be supported:

Route Code	Request ID	Command	CSC Function
8	8	Activate/Inhibit HIM Test	ai_him_test()
12	11	Activate / Inhibit HIM test on specified HIM	him_test_ai_him()
12	10	Activate / Inhibit HIM test on specified FD	him_test_ai_fd()

3.3.2 GSE HIM Hardware Test CSC External Interfaces

3.3.2.1 GSE HIM Hardware Test Message Formats

3.3.2.1.1 HIM Test Fail

Message Number = _____
Message Group = _____
Severity = Error

HIM %x card %x channel %d failed %s test. Response = %x

Insert #1	integer	HIM address
Insert #2	integer	HIM card
Insert #3	integer	HIM channel
Insert #4	text string	Test name

- all one's
- all zero's
- 20% cal
- 80% cal

Insert #5	integer	HIM response data

A discrete or digital pattern input card failed either the all one's or all zero's test.

An analog input card failed either the 20% or 80% calibration test. The returned value must be within on count of 0x33 for the 20% test and 0xcc for the 80% test.

3.3.2.1.2 Switch Scan Fail

Message Number = _____
Message Group = _____
Severity = Error

HIM %x card %d channel %d failed switch scan. Is %x expected %x

Insert #1		integer	HIM address
Insert #2	integer		HIM card
Insert #3		integer	HIM channel
Insert #4		integer	Actual HIM response data
Insert #5		integer	Expected HIM response

A discrete or digital pattern output card has changed state prior to the last read. This state change was not due to a command from this gateway.

An analog output card has changed state prior to the last read. This state change was not due to a command from this gateway.

3.3.2.2 GSE HIM Hardware Test CSC C-to-C Communications

3.3.2.2.1 Activate / Inhibit HIM Testing

Activate/Inhibit HIM Test(Routing Code 8, Request ID 8)

Bytes	COMMAND	Bytes	RESPONSE
	Header		Header
2	0 = Inhibit 1 = Activate		
2	0 = HIM test 1 = Switch scan 2 = HIM test and switch scan		

Return Codes:

- Success
- Invalid gateway mode

3.3.2.2.2 Activate / Inhibit HIM Testing on a HIM

GSE Activate/Inhibit HIM Testing on a HIM (Routing Code 12, Request ID 11)

Bytes	COMMAND	Bytes	RESPONSE
	Header		Header
2	HIM address		
2	0 = Inhibit 1 = Activate		

Return Codes:

- Success
- Invalid gateway mode
- Invalid HIM address

3.3.2.2.3 Activate / Inhibit HIM Testing on an FD

GSE Activate/Inhibit HIM Testing on an FD (Routing Code 12, Request ID 10)

Bytes	COMMAND	Bytes	RESPONSE
	Header		Header
4	FDID		
2	0 = Inhibit 1 = Activate		

Return Codes:

- Success
- Invalid gateway mode
- Invalid FDID

3.3.2.3 GSE HIM Hardware Test CSC External Interface Calls

3.3.2.3.1 Activate/Inhibit HIM Test

```
void ai_him_test (      GCPS_COMMAND_INFO_TYPE *info,
                        void *body);
```

Description: Activates or inhibits HIM hardware testing globally.

Parameters:		
	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body.

Returns: None

3.3.2.3.2 Activate/Inhibit HIM Test on a HIM

```
void him_test_ai_him (  GCPS_COMMAND_INFO_TYPE *info,
                        void *body);
```

Description: Activates or inhibits HIM hardware testing on the specified HIM.

Parameters:		
	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body.

Returns: None

3.3.2.3.3 Activate/Inhibit FD Polling

```
void him_test_ai_fd (   GCPS_COMMAND_INFO_TYPE *info,
                        void *body);
```

Description:	Activates or inhibits HIM hardware testing on the specified FDID	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body.
Returns:	None	

3.3.3 GSE HIM Hardware Test CSC Test Plan

3.3.3.1 Environment

A development GSE gateway will be connected to a mini-HIM which contains a defined set of I/O cards. At least one card for each of the data types supported will be present. TCID tables which support the mini-HIM configuration will be present on the GSE gateway local hard drive. Each of the commands supported by this CSC will be sent and the response verified. The action taken by the command will also be verified.

3.3.3.2 Test tools

The GSE gateway will be commanded using a CCP simulator test tool developed by the gateway group. This tool is capable of generating and displaying the responses of all GSE gateway commands supported.

3.3.3.3 Test Cases

A test case will be defined for each command that is processed by this CSC.

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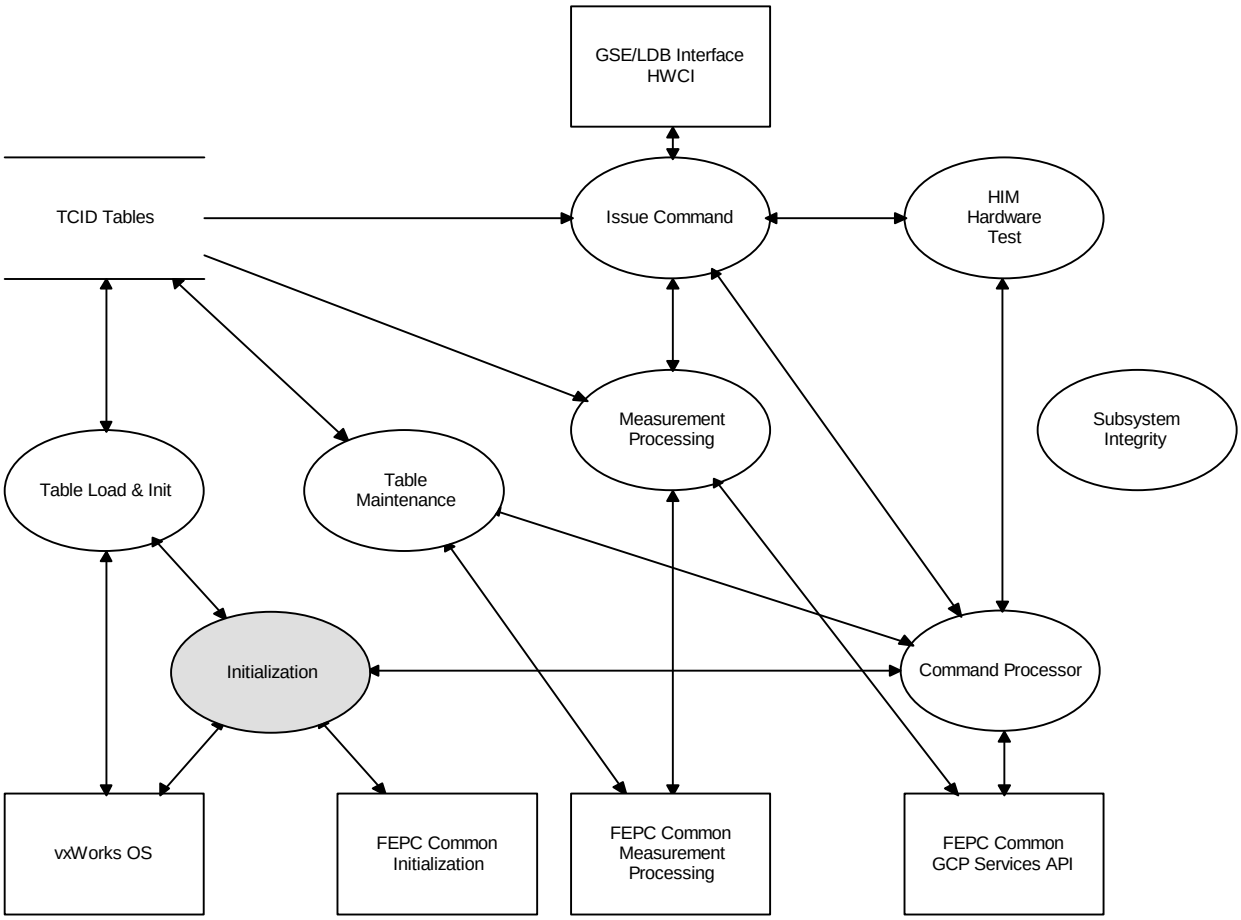
4. GSE Initialization CSC

4.1 GSE Initialization CSC Introduction

4.1.1 GSE Initialization CSC Overview

The GSE Initialization CSC is responsible for performing all initialization which is unique to the GSE Front End Control Processor. The GSE Initialization CSC provides the table load and activate functions required by the FEPC Common Initialization CSC which is part of Common Gateway Services CSCI. The GSE Initialization CSC also processes all initialization commands which are GSE specific.



4.1.2 GSE Initialization CSC Description

The GSE Initialization CSC provides the table load and activate functions required by the FEPC Common Initialization CSC which is part of Common Gateway Services. These routines are called during processing of commands issued by OPS/CM. The table load function performs GSE specific TCID table loads. The activate function performs GSE specific activation which includes initialization of the front end hardware as well as all GSE Gateway Services CSC's.

4.2 GSE Initialization CSC Specifications

4.2.1 GSE Initialization CSC Groundrules

None

4.2.2 GSE Initialization CSC Functional Requirements

1. GSE Initialization will support the following initialization commands:
   - *1.1.* Activate/Inhibit Data Acquisition *(New for Thor)*
   - *1.2.* Activate/Inhibit Data Processing *(New for Thor)*
   - *1.3.* Activate/Inhibit Command Issuance Globally *(New for Thor)*
   - *1.4.* Determine HIM Presence *(New for Thor)*
   - 1.5. Terminate

2. GSE Initialization will record initialization messages on local storage media.

3. GSE Initialization will generate a system message prior to termination, whether due to an error or by command.

4. GSE Initialization will record all termination messages on local storage media.

5. GSE Initialization will be capable of generating system messages through the Gateway Common Services CSCI using the GCP Services API.

6. GSE Initialization will be capable of requesting through the GCP Services API that a message be written to a file on the local hard drive or the local console port.

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7. GSE Initialization will process requests to activate/inhibit data acquisition.

8. GSE Initialization will process requests to activate/inhibit data processing.

9. GSE Initialization will process requests to activate/inhibit command issuance globally.

10. GSE Initialization will not activate an individually inhibited TEI command when processing the global command issuance command.

11. GSE Initialization will issue a FAIL RESET, LOCKOUT RESET, SR RESET and SR I READ (HIM wake-up sequence) to all 256 possible HIMs during processing of the following commands:
    - 11.1. Activate gateway
    - 11.2. Activate data acquisition
    - 11.3. Determine HIM presence

12. GSE Initialization will maintain status indicating which HIMs are present based on the result of the HIM wake-up sequence.

13. GSE Initialization will issue a system message if any HIMs defined in the CMDT are not present.

14. GSE Initialization will issue a system message if any HIMs are present which are not in the CMDT.

15. GSE Initialization will process command requests to determine HIM presence.

16. GSE Initialization will repeat the HIM wake-up sequence if a determine HIM presence command is received while data acquisition is inhibited.

17. GSE Initialization will return the result of the last HIM wake-up sequence if a determine HIM presence command is received while data acquisition is enabled.

18. GSE Initialization will validate the GSE facility configuration as part of the following commands:
    18.1. Activate gateway
    18.2. Activate data acquisition
    18.3. Determine HIM presence

19. GSE Initialization will issue a system message indicating success or failure of facility verification.

20. GSE Initialization will terminate the activate data acquisition command and generate a fail response if facility verification fails and facility verification override has not been specified.

21. GSE Initialization will bypass facility verification if facility verification override is specified in the activate data acquisition command.

22. GSE Initialization will output a system message indicating facility verification was not performed if facility verification override is specified in the activate data acquisition command.

23. GSE Initialization will make the result of the facility verification available to Subsystem Integrity for health / status output and display.

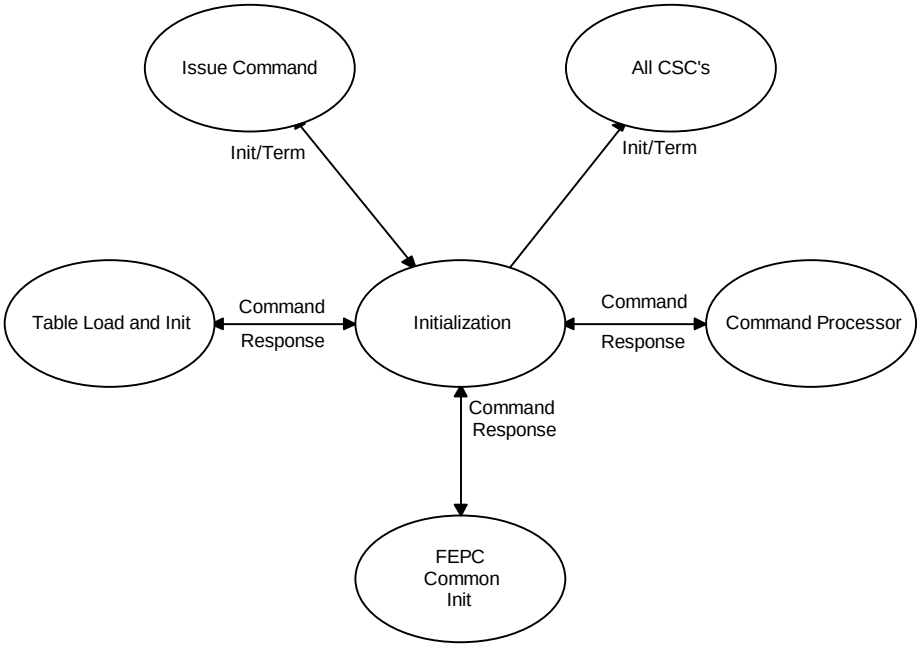
24. GSE Initialization will read the HIM output status prior to the start of data acquisition and update status in the CMDT.

4.2.3 GSE Initialization CSC Performance Requirements

No performance requirements have been identified for this CSC.

4.2.4 GSE Initialization CSC Interfaces Data Flow Diagrams

External Data Flow Diagram



The GSE Initialization CSC provides functions which are called as part of command processing by the GSE Command Processor CSC and the FEPC Common Initialization CSC which is part of the Gateway Common Services CSCI.

The GSE Initialization CSC calls a GSE unique table load function in the GSE GSE Table Load and Initialization CSC as part of the load tables function.

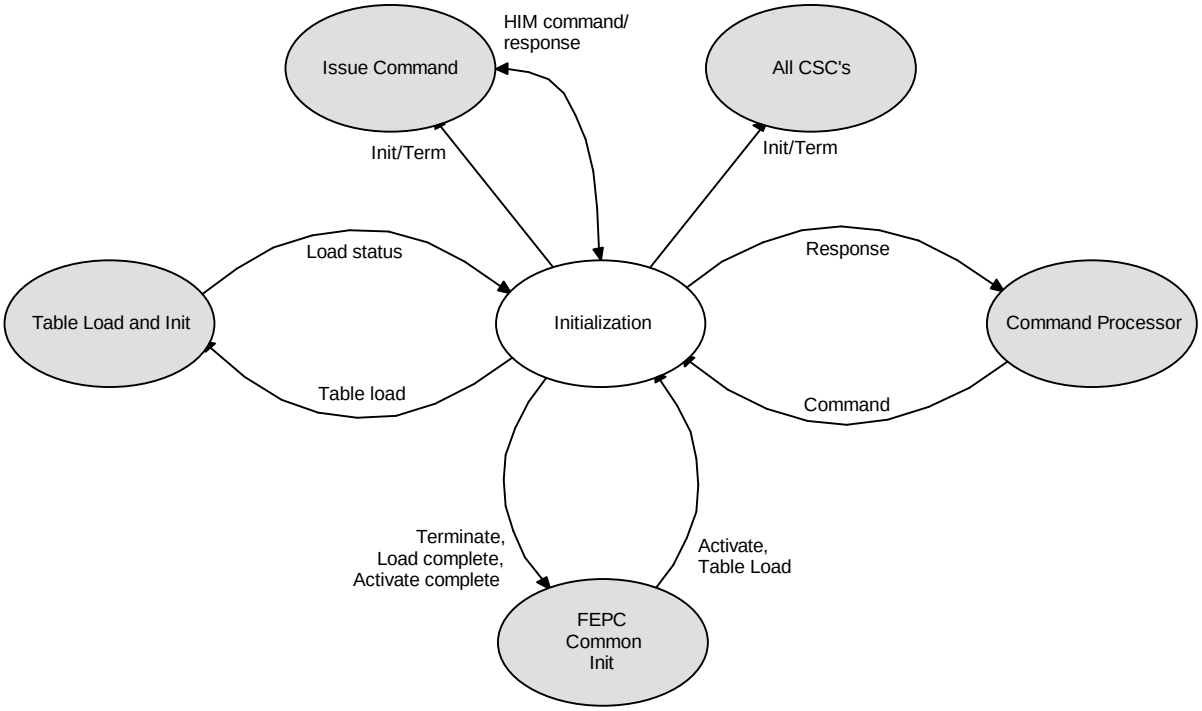
The GSE Initialization CSC controls the initialization and termination of all other GSE unique CSC's on the GSE Front End Process Controller (FEPC). CSC initialization is performed by calling an initialization function provided by each CSC. All CSC's also provide a termination function which is called when a Terminate command is received.

The GSE Initialization CSC interfaces to the GSE Issue Command CSC in order to perform the HIM rollcall and switch scan functions.

4.3 GSE Initialization CSC Design Specification

4.3.1 GSE Initialization CSC Detailed Data Flow

Detailed Data Flow Diagram



The GSE Initialization CSC provides functions which are called as part of command processing by the GSE Command Processor CSC and the FEPC Common Initialization CSC which is part of the Gateway Common Services CSCI.

The GSE Initialization CSC provides GSE unique table load and activate functions to the FEPC Common Initialization CSC which are called during processing of the Init_TCID and Activate commands respectively.

The GSE Initialization CSC calls a GSE unique table load function in the GSE GSE Table Load and Initialization CSC as part of table load processing. This function returns a status as to the success of failure of the load. This status is passed back to the FEPC Common Initialization CSC through the init_table_load_complete() function call.

The GSE Initialization CSC activation function performs activation of all GSE unique CSC's. Each CSC is initialized by calling an initialization function provided by that CSC. Once all CSC's have completed initialization, the init_activate_complete() function is called in the FEPC Common Initialization CSC. This call includes a status which indicates success of failure.

The GSE Initialization CSC also processes all initialization commands which are unique to GSE. These commands are listed in the following table.

Route Code	Request ID	Command	CSC Function
8	1	Activate data acquisition	activate_data_acquisition()
8	2	Inhibit data acquisition	inhibit_data_acquisition()
8	3	Activate/Inhibit global commands	ai_global_commands()
8	19	Determine HIM presence	determine_him_presence()
13	5	Activate/Inhibit data processing	ai_data_processing()
18	1	Terminate	init_terminate()

The Activate, Activate Data Acquisition and Determine HIM Presence commands cause the GSE Initialization CSC to call functions defined in the GSE Issue Command CSC in order to perform the HIM rollcall and switch scan functions.

4.3.2 GSE Initialization CSC External Interfaces

4.3.2.1 GSE Initialization CSC Message Formats

4.3.2.1.1 FEPC Terminated

Message Number = 60
Message Group = _____
Severity = Informational

GSE FEPC terminated

The GSE FEPC software has been terminated due to an error or by command.

4.3.2.1.2 Activation Failed

Message Number = 126
Message Group = _____
Severity = Error

GSE FEPC activation failed

The GSE FEPC failed to activate. Details may be found in the gateway local error log

4.3.2.2 GSE Initialization CSC C-to-C Communications

4.3.2.2.1 Activate Data Acquisition

GSE, Activate Data Acquisition (Routing Code 8, Request ID 1)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
2	Facility Verification Over-ride 0 = Perform facility verification 1 = Inhibit facility verification		

Response Completion Codes:

- Successful
- Invalid gateway mode
- Fail

4.3.2.2.2 Inhibit Data Acquisition

Inhibit Data Acquisition (Routing Code 8, Request ID 2)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header

Response Completion Codes:

- Successful
- Invalid gateway mode
- Fail

4.3.2.2.3 Activate/Inhibit Global Commands

GSE Activate/Inhibit. Global Command Issuance (Routing Code 8, Request ID 3)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
2	Activate/Inhibit Indicator 0 = inhibit 1 = activate		

Response Completion Codes:

- Successful
- Invalid gateway mode
- Fail

4.3.2.2.4 Determine HIM Presence

GSE Determine HIM Presence (Routing Code 8, Request ID 19)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
		2	HIM Presence Table Status 0 = not built 1 = built at software load time 2 = built on previous 3 = built on current
		32	HIM presence table

Response Completion Codes:

- Successful
- Fail

4.3.2.2.5 Activate/Inhibit Data Processing

Activate/Inhibit Processing All (Routing Code 13, Request ID 5)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
2	0 = Inhibit processing1 = Activate processing		
2	0 = Perform immediately 1 = Perform with reset		

Response Completion Codes:

- Successful
- Invalid gateway mode
- Fail

4.3.2.2.6 Terminate

Terminate Subsystem (Routing Code 18, Request ID 1)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header

Response Completion Codes:

- Successful
- Invalid gateway mode
- Failed

4.3.2.3 GSE Initialization CSC External Interface Calls

4.3.2.3.1 GSE Table Load

void gse_table_load (GCPS_COMMAND_INFO_TYPE *info,
void *body,
char *directory);

Description:	Activates all CSC's associated with a GSE gateway	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body.
	directory	Pointer to a character string which contains the path to the TCID files
Returns:	None	

4.3.2.3.2 TCID Load Status

void init_table_load_complete (int status);

Description:	Function which is called by the Table Load and Init CSC when it has completed loading and verification of the TCID tables. This function will cause a transition to Ready Mode if status is successful.	
Parameters:	status	Load status 0=successful, non-zero = fail
Returns:	None	

4.3.2.3.3 GSE Activate

void gse_activate (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description:	Activates all CSC's associated with a GSE gateway	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body. Not used by this command
Returns:	None	

4.3.2.3.4 Activate Data Acquisition

void activate_data_acquisition (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description:	Activates all CSC's associated with a GSE gateway	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body. Not used by this command
Returns:	None	

4.3.2.3.5 Inhibit Data Acquisition

void inhibit_data_acquisition (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description:	Activates all CSC's associated with a GSE gateway	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body. Not used by this command
Returns:	None	

4.3.2.3.6 Activate/Inhibit Data Processing

void ai_data_processing (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description:	Activates all CSC's associated with a GSE gateway	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body. Not used by this command
Returns:	None	

4.3.2.3.7 Activate/Inhibit Global Commands

void ai_global_commands (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description:	Activates all CSC's associated with a GSE gateway	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body. Not used by this command
Returns:	None	

4.3.2.3.8 Determine HIM Presence

void determine_him_presence (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description:	Activates all CSC's associated with a GSE gateway	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body. Not used by this command
Returns:	None	

4.3.2.3.9 Terminate

void init_terminate (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description:	Activates all CSC's associated with a GSE gateway	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body. Not used by this command
Returns:	None	

4.3.3 GSE Initialization CSC Test Plan

4.3.3.1 Environment

A development GSE gateway will be connected to a mini-HIM which contains a defined set of I/O cards. At least one card for each of the data types supported will be present. TCID tables which support the mini-HIM configuration will be present on the GSE gateway local hard drive. Each of the commands supported by the Initialization CSC f will be sent. The action taken and the response returned will be verified.

4.3.3.2 Test Tools

The GSE gateway will be commanded using a CCP simulator test tool developed by the gateway group. This tool is capable of generating and displaying the responses of all GSE gateway commands supported.

4.3.3.3 Test Cases

A test case will be defined for each command processed by this CSC

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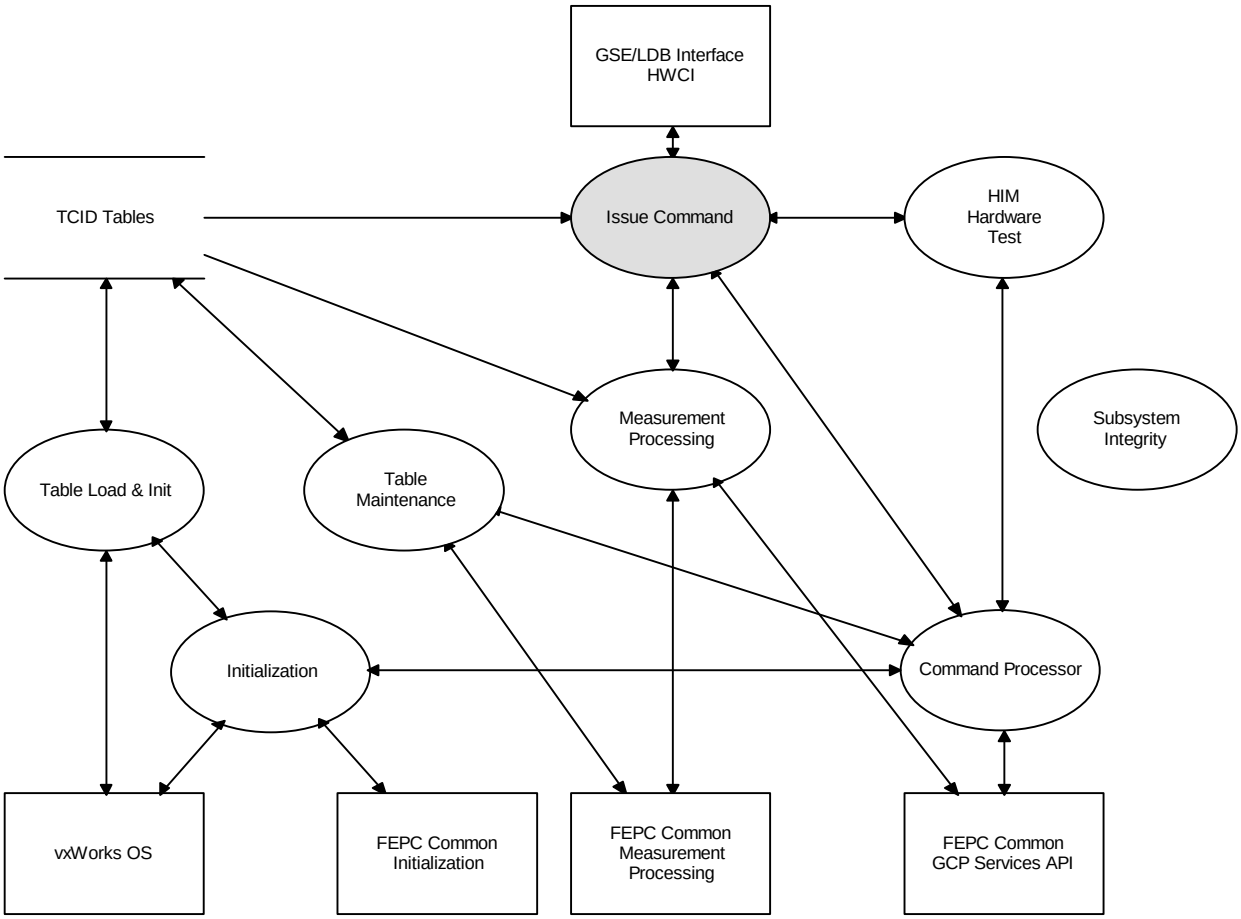
5. GSE Issue Command CSC

5.1 GSE Issue Command CSC Introduction

5.1.1 GSE Issue Command CSC Overview

The GSE Issue Command CSC is responsible for all communications with the GSE/LDB Interface HWCI and thus with the HIM Ground Data Bus (GDB). This CSC will accept requests for command and measurement polls. These requests will be translated into the format required by the HWCI and transmitted on the GDB. The response will be returned to a queue which is specified as part of the poll request. This CSC is responsible for:

- Detecting all HIM related errors and for notifying CLCS via the system message interface when an error occurs.
- Initializing the GSE/LDB Interface HWCI.



5.1.2 GSE Issue Command CSC Operational Description

The GSE Issue Command CSC provides several function calls for use by other CSC's. These function calls contain all information required to format a request for the HIM GDB. The calls also contain a message queue id parameter. The message queue is the destination for the HIM response data and status.

The GSE Issue Command CSC will format the request for output on the GDB and will store information about the GDB transaction and it's final destination on an expected response queue. The GSE Issue Command CSC will receive the response from the GDB, check it for errors, and place the response data and status on the specified queue.

If errors are detected, the GSE Issue Command CSC will output a system message containing the reason for the error. The HIM status register will be read and reset for those errors which require the status register to be cleared.

5.2 GSE Issue Command CSC Specifications

5.2.1 GSE Issue Command CSC Groundrules

- GSE Gateway Services will support the following data types:
  - Discrete Stimulus (DS)
  - Discrete Measurement (DM)
  - Analog Stimulus (AS)
  - Analog Measurement (AM)
  - Digital Pattern Stimulus (DPS)
  - Digital Pattern Measurement (DPM)

5.2.2 GSE Issue Command CSC Functional Requirements

1. GSE Issue Command will be capable of supporting at least 16 HIM's on the GSE data bus.

2. GSE Issue Command will send a system message when any GSE data bus or HIM errors are detected.

3. GSE Issue Command will inhibit the polling of a HIM upon detection of a terminal error defined as a HIM Bus Test Error, a HIM Power Failure, or a HIM Failure Signal.

4. When a HIM is inhibited due to error or by manual command, GSE Issue Command will update measurement and command status for all FDIDs associated with the HIM.

5. When a HIM is inhibited due to error or by manual command, GSE Issue Command will output a system message.

6. GSE Issue Command will provide the capability to detect and report non-terminal HIM hardware failures (Over Temperature Warning, Logic Error, Ready Time-out, Multiple Acknowledge, and Acknowledge Time-out).

7. GSE Issue Command will inhibit polling on a HIM channel upon detection of a non-terminal error response from that channel.

8. When a measurement is inhibited due to error, GSE Issue Command will output a system message.

9. GSE Issue Command will continue polling the HIM when a non-terminal error is detected.

10. GSE Issue Command will detect error conditions on the GSE data bus.

11. GSE Issue Command will issue a bus request to read the HIM Status Register II prior to issuing a status register reset command to a HIM during error processing.

12. GSE Issue Command will include the HIM Status Register II contents in the system message that reports the error condition.

13. GSE Issue Command will issue a HIM status register reset for all non-terminal HIM errors except successive over-temperature warning from a HIM.

14. GSE Issue Command will perform hardware address verification to the card address level for all responses from HIM's.

15. GSE Issue Command will provide the capability to detect HIM hardware address miscompare error conditions.

16. GSE Issue Command will continue HIM polling when hardware address miscompare errors occur.

17. GSE Issue Command will send a system message to report a HIM hardware address miscompare.

18. GSE Issue Command will be capable of generating system messages through the Gateway Common Services CSCI using the GCP Services API.

19. GSE Issue Command will be capable of requesting through the GCP Services API that a message be written to a file on the local hard drive or the local console port.

20. GSE Issue Command will maintain HIM status.

21. GSE Issue Command will maintain hardware error counters.

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22. GSE Issue Command will issue HIM status register reset commands without regard to whether global command issuance has been inhibited.

23. GSE Issue Command will not issue status register reset commands to a HIM which has been inhibited during HIM error processing.

24. GSE Issue Command will report over-temperature warnings only if the previous status register read did not contain an over-temperature warning (consecutive over-temperature warnings will not be reported).

25. GSE Issue Command will not request a status register reset if the over-temperature warning is the only error reported in the status register.

26. GSE Issue Command will maintain the following information and make it available to subsystem integrity and to the gateway maintenance interface:
    - 26.1. Fail signal count
    - 26.2. Power supply fail count
    - 26.3. Acknowledge time-out count
    - 26.4. Multi-ack error count
    - 26.5. Ready time-out count
    - 26.6. Bus test error count
    - 26.7. Logic error count
    - 26.8. Over-temperature warning count
    - 26.9. Status register resets issued count
    - 26.10. GDB length error count
    - 26.11. GDB parity error count
    - 26.12. GDB manchester error count
    - 26.13. GDB timeout error count
    - 26.14. GDB SR error count
    - 26.15. GDB unsolicited response error count
    - 26.16. Measurement poll count
    - 26.17. Command count

27. GSE Issue Command will validate both global and individual command inhibit status before issuing a TEI command.

28. GSE Issue Command will initialize the front end interface hardware upon receipt of an activate command.

29. GSE Issue Command will, upon receiving three consecutive errors on the same HIM channel, inhibit output of system messages for that channel.

30. GSE Issue Command will, upon receiving a successful poll for a channel with system messages inhibited, reset the channel error counter and output a system message indicating that system messages have been restored for the channel.

31. GSE Issue Command will maintain the following information for each HIM (HIM status table):
    - 31.1. HIM polling active
    - 31.2. HIM inhibited by command
    - 31.3. HIM inhibited by terminal error
    - 31.4. HIM hardware testing active
    - 31.5. HIM status register I last value
    - 31.6. HIM status register II last value

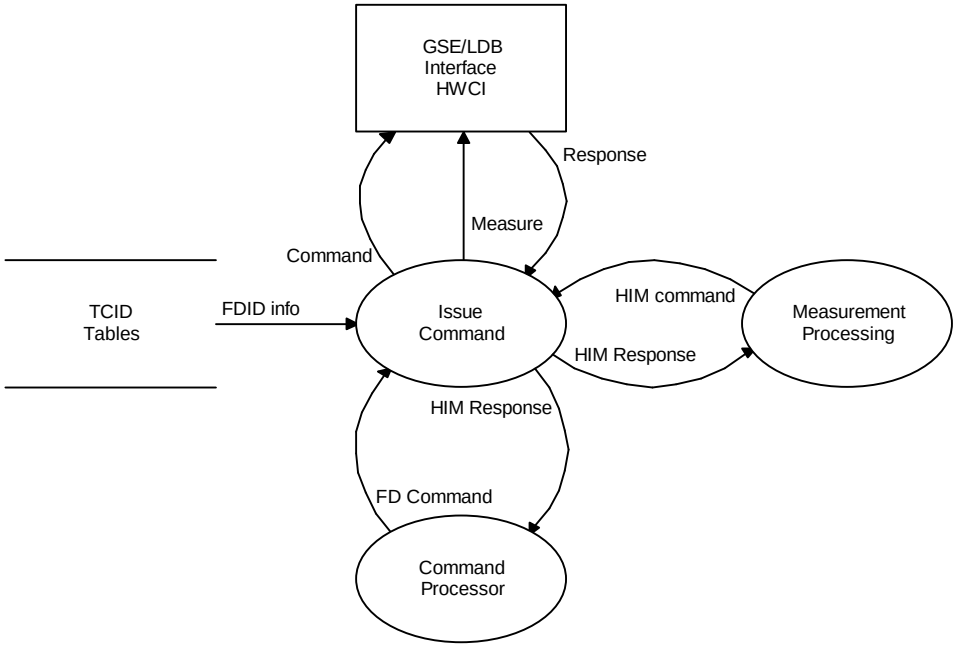
32. GSE Issue Command will make the HIM status table available to the system maintenance interface.

5.2.3 GSE Issue Command CSC Performance Requirements

1. *GSE Issue Command CSC will be capable of processing 10,000 HIM polls per second.*
2. *GSE Issue Command CSC will be capable of processing 500 uplink commands per second*

5.2.4 **GSE Issue Command CSC Interfaces Data Flow Diagrams**

External Data Flow Diagram

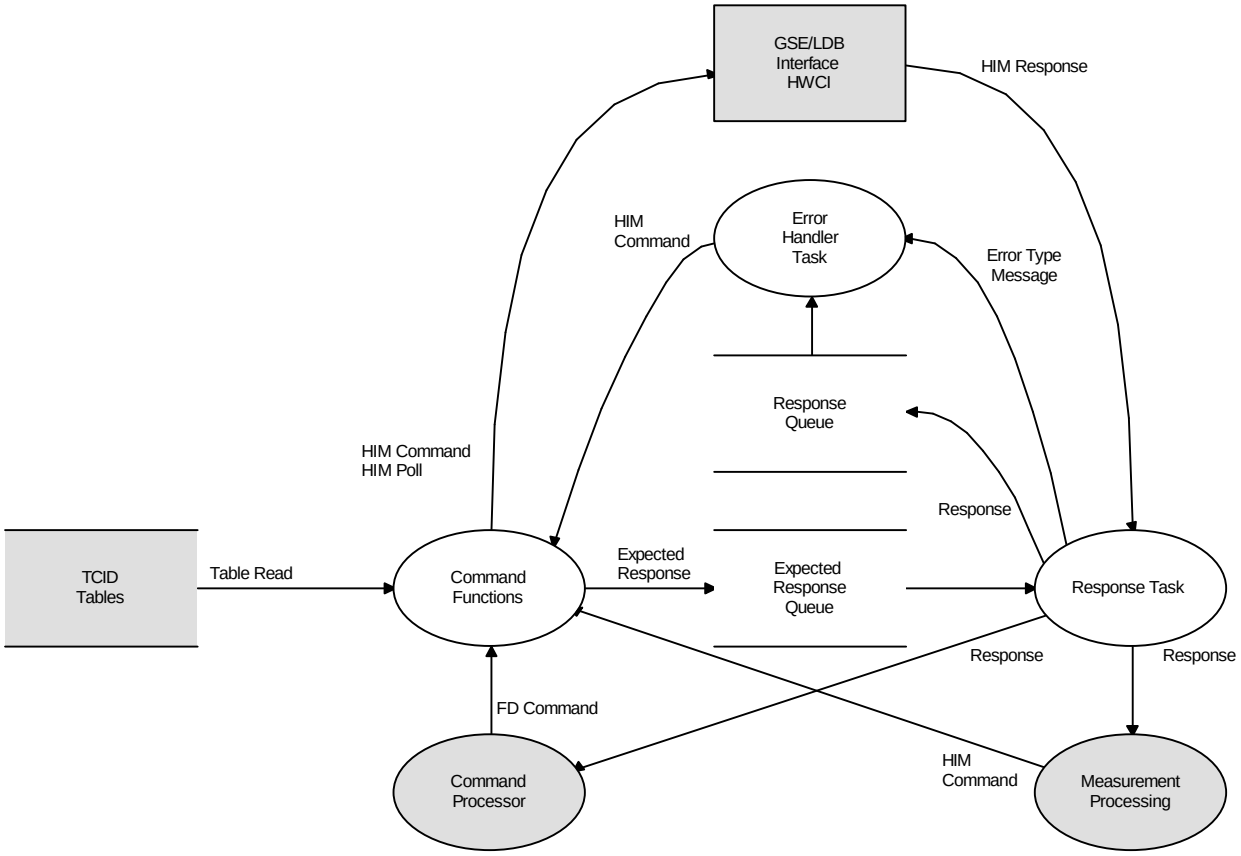


The GSE Issue Command CSC is responsible for all communications over the HIM Ground Data Bus (GDB). The CSC accepts HIM requests from any GSE Gateway Services CSC. These commands are converted to GDB format using information from the TCID tables and sent to the GSE/LDB HWCI for output to the HIM. The response from the HIM is routed from the HWCI back to the appropriate CSC. The GSE Issue Command CSC is also responsible for initializing the GSE/LDB Interface HWCI.

5.3 GSE Issue Command CSC Design Specification

5.3.1 GSE Issue Command CSC Detailed Data Flow

Detailed Data Flow Diagram



The GSE Issue Command CSC provides a function call to request a HIM poll cycle. The data passed to this function call is converted to HIM Ground Data Bus (GDB) format using data from the TCID tables. The HIM poll cycle is then output on the GDB and an entry is placed on the expected response queue.

The response task receives the HIM response data from the GDB and performs error checks. These error checks include address miscompare, parity error, discrete verification errors, Manchester error and sync error detection. The response data along with it's status is routed to the response queue defined by CSC which requested the HIM poll.

When an error is detected, the response task notifies the error handler task of the error type and the error handler task will take the appropriate action. This action may require a HIM status register read followed by a status register reset. The error handler task is also responsible for generating any system messages required.

The GSE Issue Command CSC will initialize the GSE/LDB Interface HWCI as part of subsystem initialization.

The following data types and subtypes will be supported:

Type	Subtype
AM	AU
AS	AU
DM	BD
DS	BD
DPM	DEC, OCT, HEX, BIN, BCD
DPS	DEC, OCT, HEX, BIN, BCD

5.3.2 GSE Issue Command CSC External Interfaces

5.3.2.1 GSE Issue Command CSC Message Formats

5.3.2.1.1 Response FIFO Sync Error

Message Number = 115
Message Group = _____
Severity = Critical

MICC response FIFO sync lost - FATAL ERROR: FIFO = %x %x %x

Insert #2	Integer	FIFO word 1
Insert #3	Integer	FIFO word 2
Insert #4	Integer	FIFO word 3

Each transaction through the response FIFO on the MICC contains multiple words. A fill pattern is provided in one of the words which can be checked to ensure that all the required words are in the proper order. This error indicates that the fill pattern test failed. The FIFO data is therefore unreliable. This is considered a fatal error. The FIFO contents are provided for verification purposes. Refer to the MICC maintenance manual (83k09158) for a definition of the FIFO contents..

5.3.2.1.2 Response Error

Message Number = 67
Message Group = _____
Severity = Warning

HIM response %s error: HIM %x Channel %x Data %x

Insert #1	Text String Parity Length Timeout	Manchester
Insert #2	Integer	HIM address
Insert #3	Integer	HIM channel (card/function)
Insert #4	Integer	HIM data

A Ground Data Bus error occurred during the HIM poll specified

5.3.2.1.3 HIM Error

Message Number = 68
Message Group = _____
Severity = Warning

HIM error: HIM %x Channel %x SR1 %x SR2 %x

Insert #1	Integer	HIM address
Insert #2	Integer	HIM channel (card/function)
Insert #3	Integer	8-bit status register 1 contents
Insert #4	Integer	8-bit status register 2 contents

A HIM error occurred for the specified channel. Status registers 1 and 2 define the error.

Status Register 1 Content:

Bit	Function	Description
MSB		
0	Over Temperature Warning	One or more of the eight temperature sensors is out of range
1	Logic Error	Card detected cable mate problem Undefined operation for card Command during lockout mode
2	Bus Test Error	
3	Ready Timeout	HIM internal cycle not completed within 32 µS
4	Multi-ACK	Multiple cards responded
5	Ack Timeout	HIM card did not respond within 8 µS
6	Power Supply Fail	BTC power fail or HPA AC Fail Interrupt occurred
7	Fail Signal	HIM recently powered up
LSB		

Status Register 2 Content:

Bit	Function	Description
MSB		
0 - 1	HIM Mode	0 = Remote 1 = Mixed 2 = Local 3 = Lockout
2	Card Mode	Last poll, 0 = Test, 1 = Normal
3	Card type	Last poll, 0 = measurement card, 1 = command card
4	OSE Inhibit	HIM OSE is inhibited
5	Receiver Error	HIM detected a Manchester or parity error
6	Line Power Fail	Change detected in power source
7	Local Cycle request	Set when a FP, MP or OSE cycle is processed
LSB		

5.3.2.1.4 HIM Bypassed

Message Number = 62
Message Group = _____
Severity = Critical

HIM %x bypassed due to terminal error: SR1 = %x

Insert #1	Integer	HIM address
Insert #2	Integer	Status register 1 contents

A HIM has been bypassed due a terminal error. The status register 1 contents contains the reason for the error

5.3.2.1.5 HIM Channel Bypassed

Message Number = 63
Message Group = _____
Severity = Warning

HIM %x Channel %x bypassed due to non-terminal error: SR1 = %x

Insert #1	Integer	HIM address
Insert #2	Integer	HIM channel (card/function)
Insert #3	Integer	Status register 1 contents

A HIM channel has been bypassed due to a non-terminal HIM error. The status register 1 contents contains the reason for the error

5.3.2.1.6 Required HIM not found

Message Number = 116
Message Group = _____
Severity = Warning

CMDT index %d HIM %x not found by HIM rollcall

Insert #1	Integer	CMDT index
Insert #2	Integer	HIM channel

The CMDT contains a HIM which was not found by HIM rollcall. The CMDT index which contains the HIM is shown.

5.3.2.1.7 Extra HIM found

Message Number = 117
Message Group = _____
Severity = Warning

HIM %x was found: not in CMDT

Insert #1	Integer	HIM address

HIM rollcall found a HIM which is not defined as required by the CMDT.

5.3.2.1.8 Unsolicited HIM Response

Message Number = 118
Message Group = _____
Severity = Warning

HIM unsolicited response: HIM %x, Channel %x, Data %x

Insert #1	Integer	HIM address
Insert #2	Integer	HIM channel (card/function)
Insert #3	Integer	HIM data

An unexpected response was received from a HIM

5.3.2.2 GSE Issue Command CSC C-to-C Communications

This CSC is not responsible for execution of a C-to-C command.

5.3.2.3 GSE Issue Command CSC External Interface Calls

5.3.2.3.1 HIM command

```
STATUS him_command( UNSIGNED16   him_address,
                    UNSIGNED16   him_channel,
                    MSG_Q_ID     response_q,
                    UNSIGNED32   him_poll_type,
                    UNSIGNED16   data);
```

Description: Send a HIM command or poll request based on HIM address, channel data

Parameters:

him_address	HIM address
him_channel	HIM channel
response_q	Queue ID where response data and status are to be placed
him_poll_type	Command request types: 0 HIM_COMMAND_TYPE 1 HIM_MEASURE_TYPE Poll request types: 2 HIM_COMMAND_SLOT_TYPE 3 HIM_MEASURE_SLOT_TYPE 4 HIM_NULL_SLOT_TYPE
data	HIM data for command types. Zero for measurement and NULL types.

Returns: OK or ERROR as defined by vxWorks.h

5.3.2.3.2 HIM Rollcall

```
void him_rollcall (void);
```

Description: Perform HIM roll call. This function will issue a HIM wake-up sequence to all 256 possible HIM's. The HIM status table is updated to reflect the result. A switch scan will be performed on any HIM which went from inhibited to active as a result of the roll call.

Parameters: None

Returns: None

5.3.2.3.3 Response Queue Format

The response data from either of the above commands will be placed on the queue specified by the command. The format of this queue is defined below.

```
typedef struct
{
        UNSIGNED32 status;
        UNSIGNED16 him_address;
        UNSIGNED16 him_channel;
        UNSIGNED16 him_data;
} RESPONSE_QUEUE_TYPE;
```

The status parameter will have one of the following values:

0	Successful
1	HIM timeout
2	HIM sync error
3	Manchester error
4	Parity error
5	Length Error

him_data	analogs	left justified within 16-bit unsigned integer
	discretes	8 bit channel right justified within 16-bit unsigned integer
	digital patterns	right justified within 16-bit unsigned integer

5.3.3 GSE Issue Command CSC Test Plan

5.3.3.1 Environment

A development GSE gateway will be connected to a mini-HIM which contains a defined set of I/O cards. At least one card for each of the data types supported will be present. TCID tables which support the mini-HIM configuration will be present on the GSE gateway local hard drive. Each of the commands supported by the GSE Issue Command CSC will be sent. The action taken and the response returned will be verified.

5.3.3.2 Test Tools

The GSE gateway will be commanded using a CCP simulator test tool developed by the gateway group. This tool is capable of generating and displaying the responses of all GSE gateway commands supported.

5.3.3.3 Test Cases

A test case will be defined for each command processed by this CSC.

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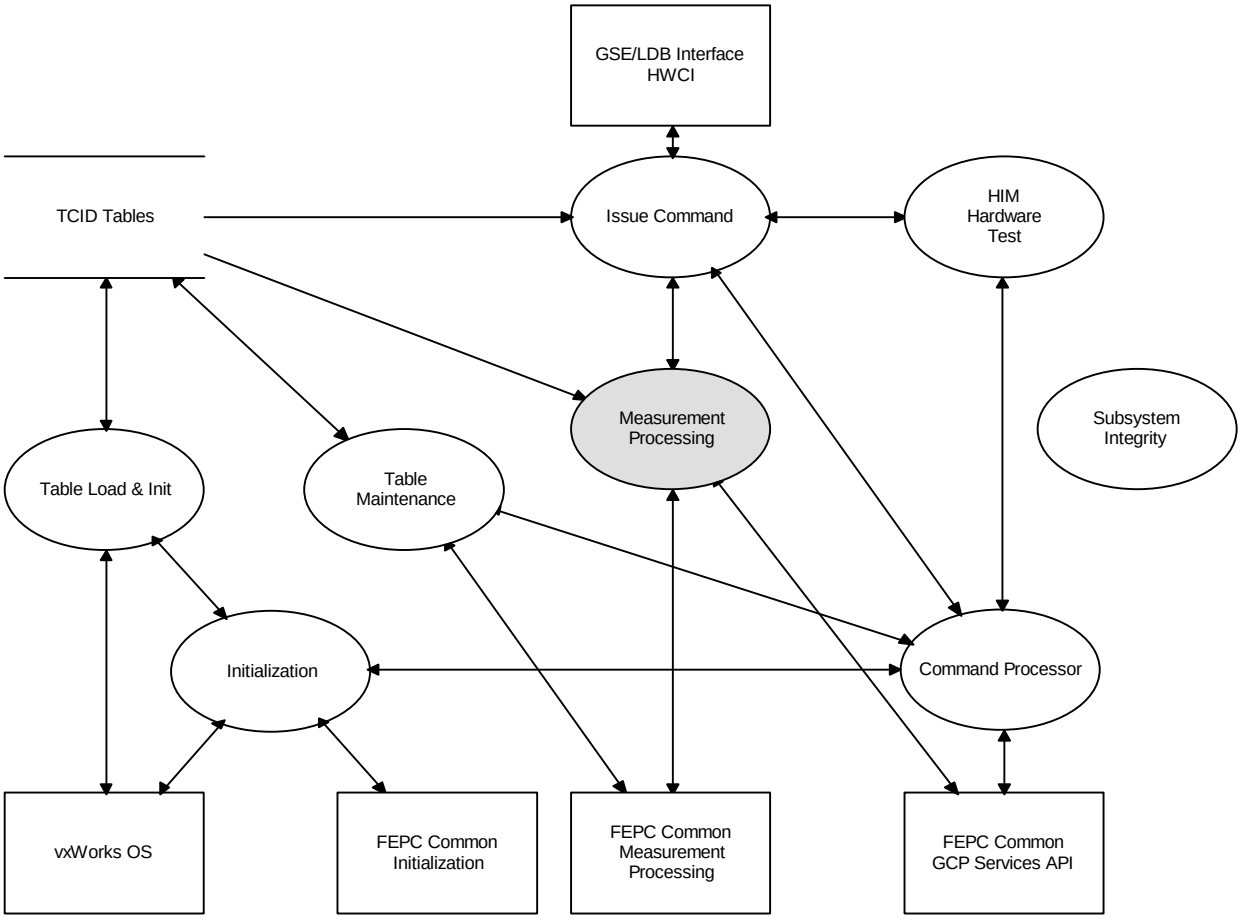
6. GSE Measurement Processing CSC

6.1 GSE Measurement Processing CSC Introduction

6.1.1 GSE Measurement Processing CSC Overview

The GSE Measurement Processing CSC is responsible for performing the measurement poll function. It uses HIM poll table and Command/Measurement Data Table (CMDT) information provided as part of the TCID tables to format and output HIM polls via the GSE Issue Command CSC. The poll responses are changed checked against their current value in the CMDT and if a change is detected, a change data write is performed via the GCP Services API.



6.1.2 GSE Measurement Processing CSC Operational Description

The GSE Measurement Processing CSC uses the three rate tables (100 Hz, 10 Hz and 1Hz) that are provided as part of the TCID to control the acquisition of measurement data from the HIM's. The CSC will cycle through the poll tables, building output requests to be passed to the HIM via the GSE Issue Command CSC. Responses from the GSE Issue Command CSC will be passed to the FEPC Common GSE Measurement Processing CSC for change checking and possible output via the GCP Services API.

6.2 GSE Measurement Processing CSC Specifications

6.2.1 GSE Measurement Processing CSC Groundrules

None

6.2.2 GSE Measurement Processing CSC Functional Requirements

1. GSE Measurement Processing will be capable of cyclically issuing polls for measurement data to the HIM's.

2. GSE Measurement Processing will support polling of GSE HIM's with standard sample rates of 1, 10, and 100 samples per second.

3. GSE Measurement Processing will allow polling at multiples of the standard sample rates.

4. GSE Measurement Processing will communicate all change data with status, FDID and time to the Gateway Common Services CSCI using the GCP Services API.

5. GSE Measurement Processing will set invalid data indicators in the measurement status upon detection of an error during a HIM poll.

6. GSE Measurement Processing will provide the capability to convert analog counts to engineering units.

7. GSE Measurement Processing will be capable of performing up to a fifth-order polynomial expansion using standard IEEE 754 floating-point 32 bit coefficients to convert the measurement data to an engineering unit form.

8. GSE Measurement Processing will maintain the current value of each measurement.

9. GSE Measurement Processing will output HIM measurement data only if a change has occurred.

10. When a measurement is inhibited due to error or by manual command, GSE Measurement Processing will update the measurement's status.

11. GSE Measurement Processing will be capable of requesting through the GCP Services API that a message be written to a file on the local hard drive or the local console port.

12. GSE Measurement Processing will provide functions to convert all GSE data types from HIM format to RTCN format (e.g. count to floating point,)

    END REDSTONE
    NEW FOR THOR

13. GSE Measurement Processing will consider data to be stale when either data acquisition and/or data processing is inhibited for a measurement.

14. GSE Measurement Processing will provide the capability to continue polling a specified HIM that has reported a Power Fail terminal error.

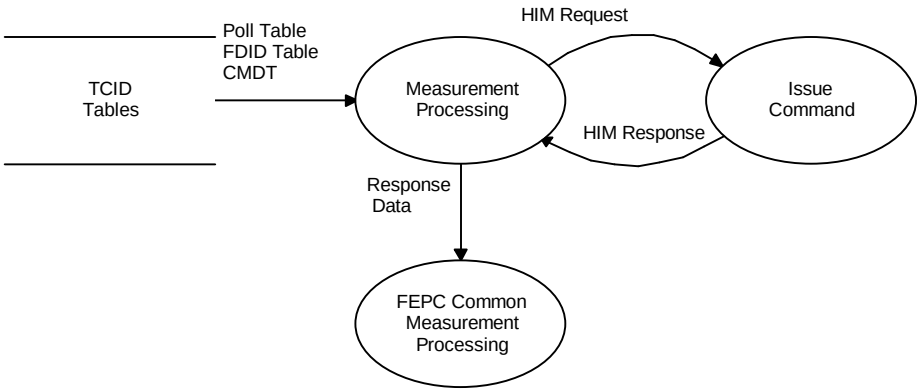
15. GSE Measurement Processing will consider data invalid upon detection of a measurement that is polled and no response is received.

6.2.3 GSE Measurement Processing CSC Performance Requirements

1. GSE Gateway Services will be capable of processing 10,000 HIM polls per second.

6.2.4 GSE Measurement Processing CSC Interfaces Data Flow Diagrams

External Data Flow Diagram

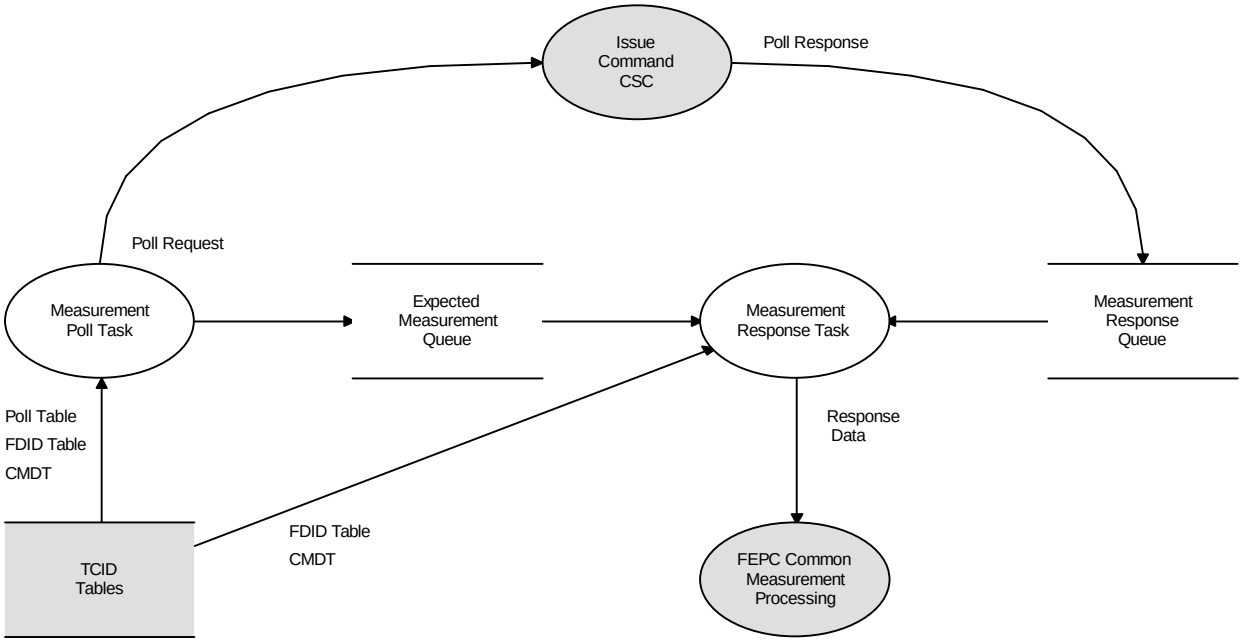


The GSE Measurement Processing CSC uses the poll tables, the FDID tables and the CMDT. It will scan the poll tables and output HIM poll requests using functions provided by the GSE Issue Command CSC. HIM responses from the GSE Issue Command CSC will be change checked and a change data write will be made if required to the GCP Services API. System Messages are also output via the GCP Services API.

6.3 GSE Measurement Processing CSC Design Specification

6.3.1 GSE Measurement Processing CSC Detailed Data Flow

Detailed Data Flow Diagram



The measurement poll task will scan the poll tables and build a poll request for each 100 µS poll slot. The poll request may be defined to be either a command slot, a measurement slot or a null slot. CMDT processing flags for HIM active and measurement active will be tested prior to output of a measurement poll. If HIM or measurement polling is inhibited, the measurement poll slot will be replaced with a null slot. The poll request it forwarded to the GSE Issue Command CSC which will format and output a GDB command. For measurement polls, the poll task will also place an expected measurement entry on the expected measurement queue.

The GSE Issue Command CSC will place the responses to the HIM polls on the measurement response queue. The measurement response task will take the data from the queue and verify it's status and that it is the next expected measurement.. Measurement processing flags for processing active will be checked in the CMDT. The data and status will be forwarded to the FEPC Common GSE Measurement Processing CSC for change checking and output via the GCP Services API.

The FEPC Common GSE Measurement Processing CSC will perform any data conversions required. This includes engineering unit conversion for analog measurements and unpacking for discretes.

6.3.2 GSE Measurement Processing CSC External Interfaces

6.3.2.1 GSE Measurement Processing CSC Message Formats

6.3.2.1.1 Change Data Queue Full

Message Number = 114
Message Group = _____
Severity = Error

Change data lost - change data queue is full

A change data write could not be completed because the change data queue is full.

6.3.2.1.2 Measurement Queue Sync Error

Message Number = 120
Message Group = _____
Severity = Critical

Expected measurement queue sync lost - FATAL ERROR

The expected measurement queue and the measurement response queues are no longer in sync. This will not happen unless either the Measurement Processor CSC or the GSE Issue Command CSC has a fatal error..

6.3.2.2 GSE Measurement Processing CSC C-to-C Communications

This CSC is not responsible for execution of a C-to-C command.

6.3.2.3 GSE Measurement Processing CSC External Interface Calls

6.3.2.3.1 Analog Unipolar to Floating Point

```
STATUS au_to_fp(    UNSIGNED16    counts,
                    int           cmdt_index,
                    FLOAT32       *eu_data);
```

Description:	Convert a 16-bit analog converted count value to an engineering unit (IEEE 754 single precision floating point) value.	
Parameters:	counts	Analog converted count value
	cmdt_index	Index into Command / Measurement Data Table for the HIM channel being converted.
	eu_data	Pointer to a 32-bit IEEE 754 single precision floating point variable where the response data will be stored.
Returns:	OK or ERROR as defined by vxWorks.h	

6.3.2.3.2 Floating Point to Analog Unipolar

```
STATUS fp_to_au(    FLOAT32     eu_data,
                    int         cmdt_index,
                    UNSIGNED16  *counts);
```

Description:	Convert an engineering unit (IEEE 754 single precision floating point) value to a 16-bit analog converted count value.	
Parameters	eu_data	32-bit IEEE 754 single precision floating point to be converted
	cmdt_index	Index into Command / Measurement Data Table for the HIM channel being converted.
:	counts	Pointer to a analog count value where converted data is to be stored.
Returns:	OK or ERROR as defined by vxWorks.h	

6.3.2.4 GSE Measurement Processing CSC Table Formats

See the GSE Table Load and Initialization CSC specification for a description of the tables required by this CSC

6.3.3 GSE Measurement Processing CSC Test Plan

6.3.3.1 Environment

A development GSE gateway will be connected to a mini-HIM which contains a defined set of I/O cards. At least one card for each of the data types supported will be present. TCID tables which support the mini-HIM configuration will be present on the GSE gateway local hard drive. Measurement polling will be activated and the change data output stream will be verified.

6.3.3.2 Test Tools

The GSE gateway will be commanded using a CCP/DDP simulator test tool developed by the gateway group. This tool is capable of generating and displaying the responses of all GSE gateway commands supported.

6.3.3.3 Test Cases

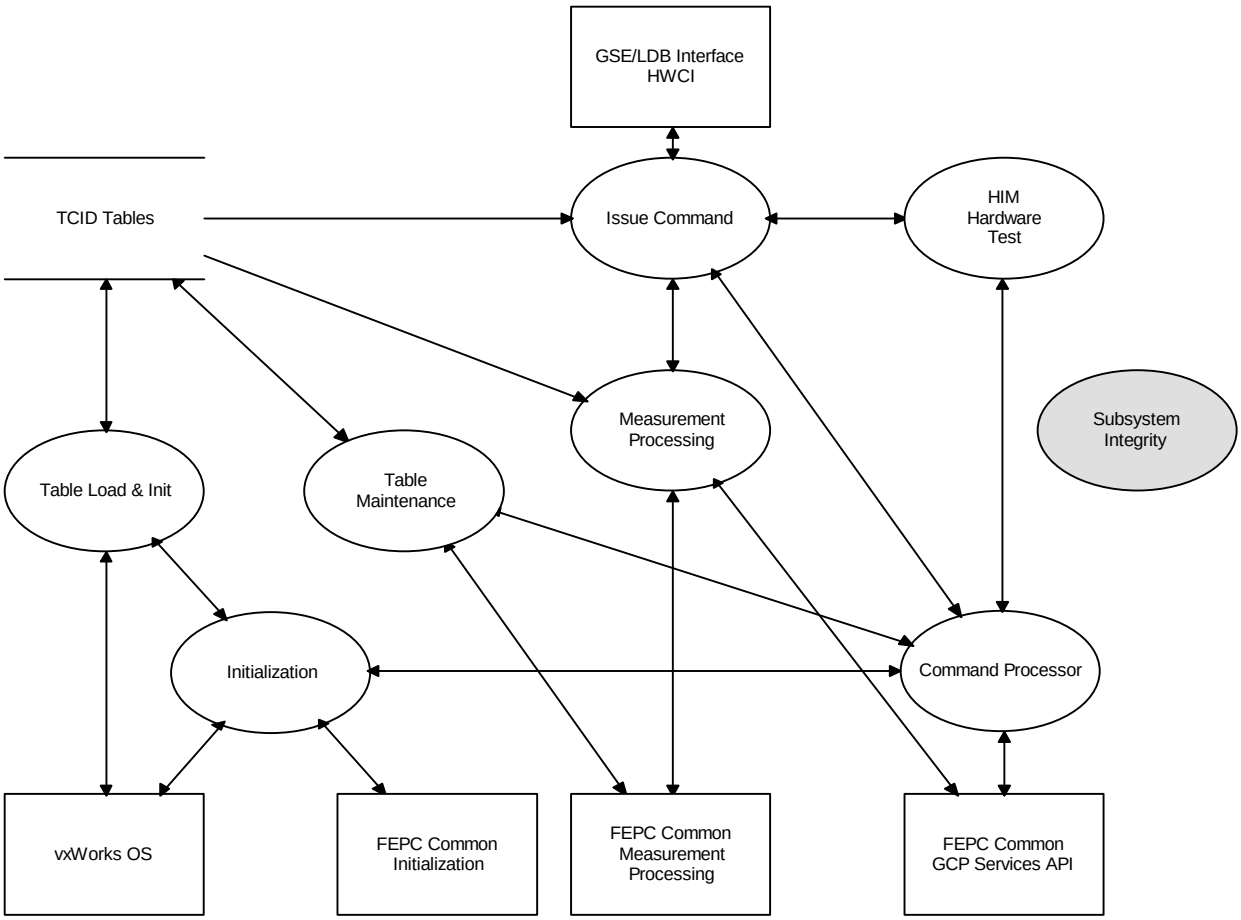
Analog measurement
Discrete measurement
Digital pattern measurement

7. GSE Subsystem Integrity CSC

7.1 GSE Subsystem Integrity CSC Introduction

7.1.1 GSE Subsystem Integrity CSC Overview

There are no GSE unique subsystem integrity functions defined for the Thor delivery. All GSE subsystem integrity requirements are being met by functions defined in the Health/Status CSC which is part of the Common Gateway Services CSCI. Post Thor, the GSE Subsystem Integrity CSC will provide GSE unique redundancy and switchover functionality.



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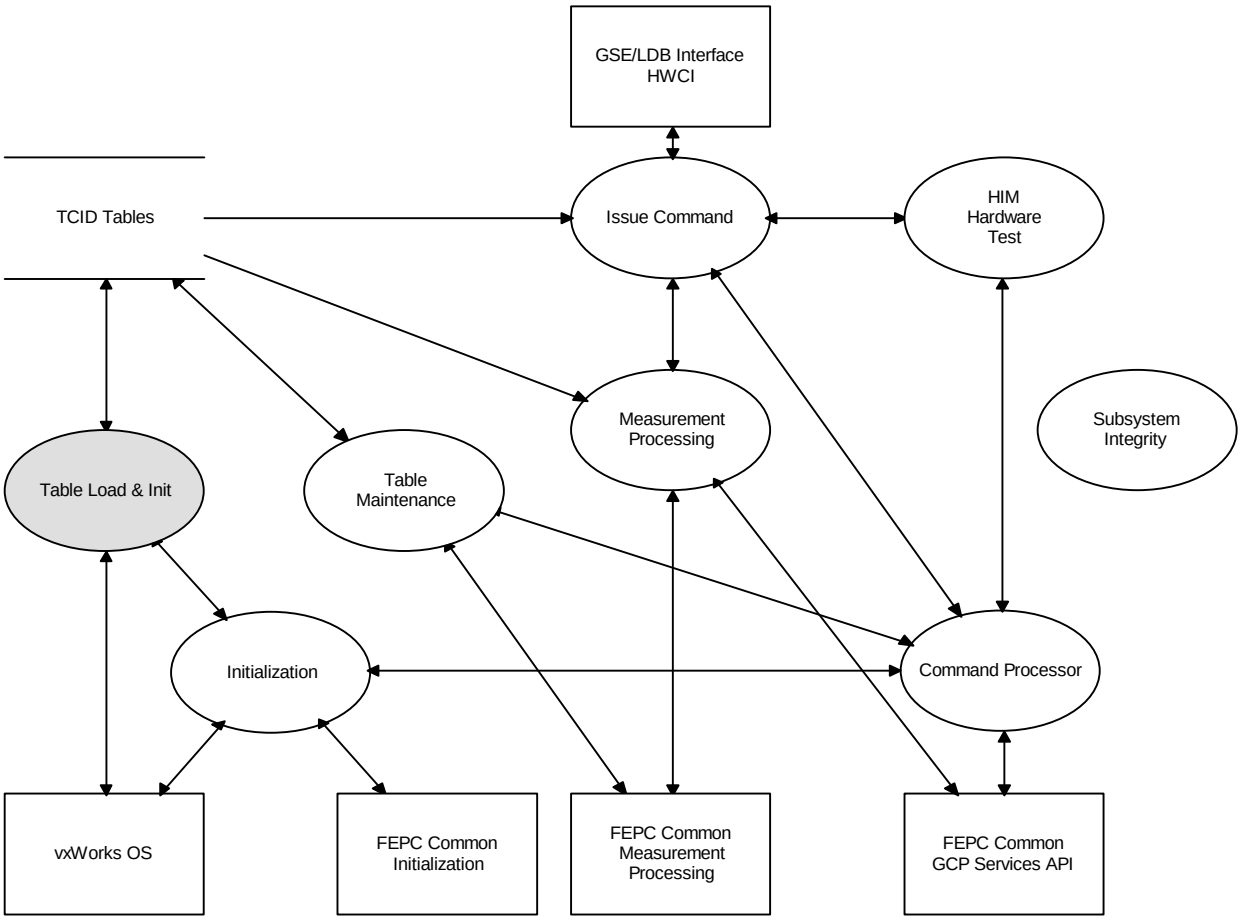
8. GSE Table Load and Initialization CSC

8.1 GSE Table Load and Initialization CSC Introduction

8.1.1 GSE Table Load and Initialization CSC Overview

The GSE Table Load and Initialization CSC is part of the GSE Gateway Services CSCI. The CSC is responsible for loading the TCID tables from the hard drive into memory and verifying their content.



8.1.2 GSE Table Load and Initialization CSC Operational Description

The GSE Table Load and Initialization CSC is commanded to load the GSE unique TCID tables from the local hard drive by the Initialization CSC in response to a Load TCID command. The TCID files to be loaded are the Command Measurement Data Table (CMDT), the poll tables (100Hz, 10Hz and 1Hz), the FDID tables for discretes and the Engineering Unit Coefficient tables. These tables are formatted as ASCII flat files on the hard drive with one record per line. The first line of each files contains the number or records in the file. The GSE Table Load and Initialization CSC will open the file, obtain the number of records, allocate memory based on the record count, use the fscanf() function to read each record and then verify that the expected number of entries are present. Once all tables are read, verification checks will be performed, such as checking limits on pointers from one table to another, etc.

8.2 GSE Table Load and Initialization CSC Specifications

8.2.1 GSE Table Load and Initialization CSC Groundrules

- System software and TCID tables will be resident on the local hard drive.
- System software will be loaded from the local hard drive during power up and on command (Initialize SCID or reboot).
- TCID tables will be loaded when an initialize TCID command is received.
- The following tables will be provided by build as part of the TCID information at load / initialization time:
  - GSE Command / Measurement Data Table
  - Polling Rate Tables (100Hz, 10Hz and 1Hz)
  - Discrete Command / Measurement FDID tables
  - Engineering Unit Conversion tables
- The interface to the Gateway Common Services CSCI on the GCP will be implemented using the GCP Services API.

8.2.2 GSE Table Load and Initialization CSC Functional Requirements

1. GSE Table Load and Initialization CSC will load all required TCID tables from the local hard drive when the Initialize TCID command is received.

2. GSE Table Load and Initialization CSC will respond to the Initialize TCID command with a success or fail status.

3. GSE Table Load and Initialization CSC will be capable of generating system messages through the Gateway Common Services CSCI using the GCP Services API.

4. GSE Table Load and Initialization CSC will be capable of requesting through the GCP Services API that a system message be written to a file on the local hard drive, the local console port, or the RTCN interface.

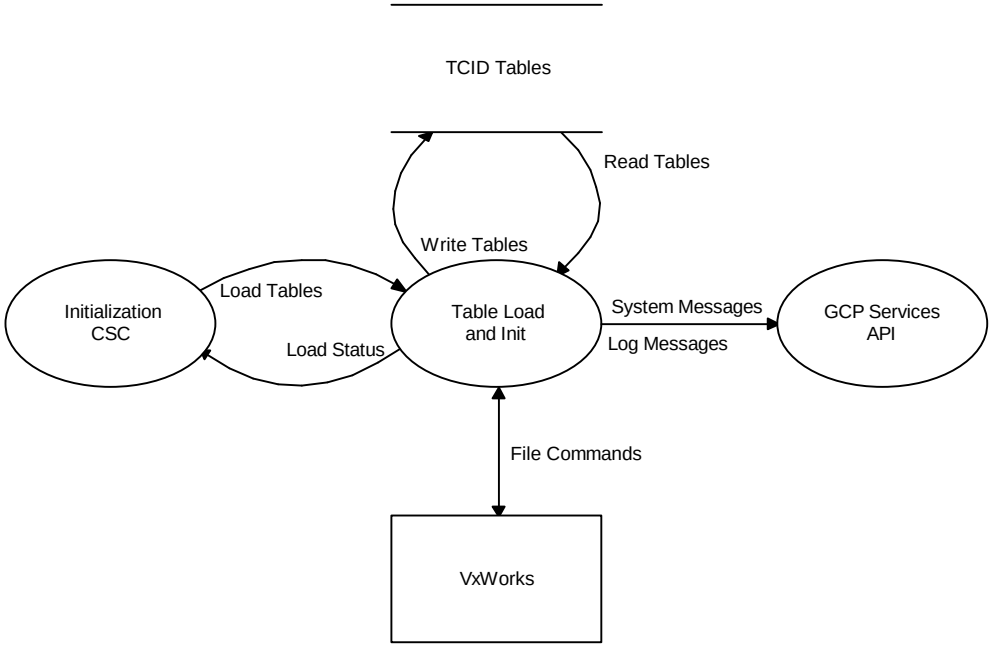
5. GSE Table Load and Initialization CSC will perform verification checks on the loaded tables.

8.2.3 GSE Table Load and Initialization CSC Performance Requirements

No performance requirements have been identified for this CSC for the Thor delivery.

8.2.4 **GSE Table Load and Initialization CSC Interfaces Data Flow Diagrams**

External Data Flow Diagram

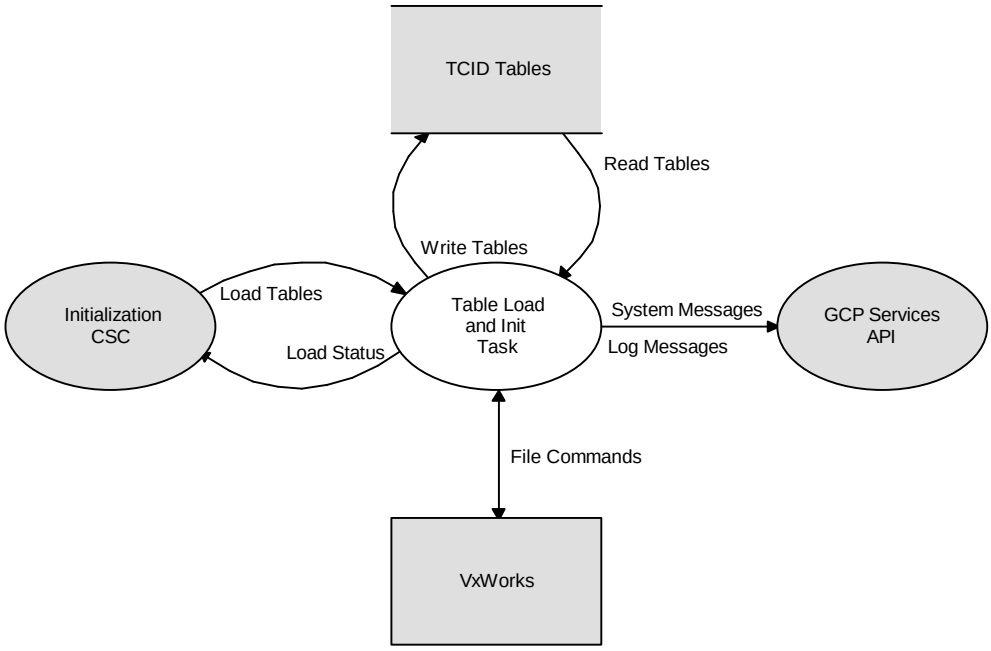


The GSE Table Load and Initialization CSC is commanded by the GSE Initialization CSC to perform the TCID table load in response to a Load TCID command. The GSE Table Load and Initialization CSC will use the fopen() function to open the files on the local hard drive. The number of records will be read and memory allocated based on the record size. The fscanf() function will be used to read each record into the table. When the end of the file is reached, the record count will be verified. Once all files are read, the GSE Table Load and Initialization CSC will perform verification checks.

8.3 GSE Table Load and Initialization CSC Design Specification

8.3.1 GSE Table Load and Initialization CSC Detailed Data Flow

Detailed Data Flow Diagram



The GSE Table Load and Initialization CSC provides a load_tables() function call to the Initialization CSC which will be performed in response to a Load TCID command. This function will spawn the Table Load and Initialization task. Once table load and verification is complete, the GSE Table Load and Initialization CSC will call the table_load_status() function provided by the Initialization CSC to inform that CSC of the load status. The following checks will be performed as a minimum:

1. Pointers from one table to another will be limit checked.
2. EU coefficients which are used by the CMDT will be tested to ensure at least a first order polynomial is present.
3. The 100 Hz poll table will be verified to contain 100 entries
4. The 10 Hz and 1 Hz tables will be verified to contain a multiple of 10 entries

Table load and verification status will be output to the local log file via the GCP Services API. A system message will be generated via the same API if an error occurs during load or verification.

8.3.2 GSE Table Load and Initialization CSC External Interfaces

8.3.2.1 GSE Table Load and Initialization CSC Message Formats

8.3.2.1.1 Memory Allocation Error

Message Number = 121
Message Group = _____
Severity = Error

Unable to allocate memory for %s table.

Insert #1 Text String Table Name

- Command/Measurement
- DM FDID
- DS FDID
- EUC
- 100Hz poll
- 10 Hz poll
- 1 Hz poll

8.3.2.1.2 File Open Failure

Message Number = 122
Message Group = _____
Severity = Error

Unable to open file %s

Insert #1 Text String File Name

- cmdt
- dm_fdid
- ds_fdid
- euc
- polling

8.3.2.1.3 File Read Failure

Message Number = 123
Message Group = _____
Severity = Error

Unable to read file %s

Insert #1 Text String File Name

- cmdt
- dm_fdid
- ds_fdid
- euc
- polling

8.3.2.1.4 File Scan Failure

Message Number = 124
Message Group = _____
Severity = Error

Scan error reading file %s at line %d

Insert #1	Text String	File name • cmdt • dm_fdid • ds_fdid • euc • polling
Insert #2	Integer	Line number

Details:

An error occurred while reading the specified file at the indicated line. Either the number of elements in the record was incorrect or an unexpected end-of-file was encountered.

8.3.2.1.5 Invalid Table Index

Message Number = 125
Message Group = _____
Severity = Error

Invalid index in %s table: entry %d, index %d

Insert #1	Text String	Table Name • Command/Measurement • DM FDID • DS FDID • EUC • 100Hz poll • 10 Hz poll • 1 Hz poll
Insert #2	Integer	Table entry number
Insert #3	Integer	Index which is invalid

Table verification failure. An index was found in the indicated table which is not within the legal range for the table being pointed to.

8.3.2.2 C-to-C Communications

This CSC is not responsible for managing any of the GSE C-to-C communications.

8.3.2.3 GSE Table Load and Initialization CSC External Interface Calls

8.3.2.3.1 Load Tables Command

STATUS load_tables(char * path);

Description:	Command the Table Load and Init CSC to load the TCID tables. This function will issue a semaphore to the Table Load and Init Task.	
Parameters:	path	A pointer to a character string containing the path to the directory where the TCID tables are located. The path string is terminated by a "/" character
Returns:	OK or ERROR as defined by vxWorks.h	

8.3.2.4 GSE Table Load and Initialization CSC Table Formats

All tables are represented a ASCII flat files with one record per line. The first line of each file contains the record count

8.3.2.4.1 Command / Measurement Data Table

The CMDT contains a record for each HIM channel that may be either commanded or polled. Each record contains the following data in the order specified:

type
subtype
him_address
him_channel
enable_mask
index
fdid
default_rate

type — Data type indicator.

1	AM
2	AS
3	DM
4	DS
5	DPM
6	DPS

suntype

Data subtype indicator		for Type
1	AU	AM, AS
1	BD	DM, DS
1	DEC	DPM, DPS
2	OCT	DPM, DPS
3	HEX	DPM, DPS
4	BIN	DPM, DPS
7	BCD	DPM, DPS

him_address — HIM address for the command or measurement.

him_channel — HIM channel for the command or measurement.

enable_mask — Defines legal bits within this channel.

	Analog types should be 0xff (All bits are valid). Digital patterns should be as defined by the data base (e.g. 0x3f for start bit 2, length 6). Discrete measurements and commands should be 0xff unless some discretes are not used in the channel. Unused discretes should have their corresponding bit set to zero.
index	EU conversion table index for analogs. Discrete stimulus FDID table index for discrete commands. Discrete measurement FDID table index for discrete measurements. Zero for digital patterns.
fdid	FDID for analogs and digital patterns, parent FDID for discretes.
default_rate	The initial sample rate for this FDID

The TCID file on the hard drive will contain an ASCII decimal representation of each field with 7 hexadecimal numbers per line (one record). Entries within a record will be arranged in the order defined above (type first, fdid last) with at least one space between entries. The first line in the file will contain the number of records.

8.3.2.4.2 Poll Rate Tables

There are three poll rate tables, one each for 100 Hz, 10 Hz and 1Hz measurements. All three tables have the same format. The 100 Hz table will have 100 entries, allowing a 10,000 Hz maximum poll rate. The 10 Hz table must be a multiple of 10 entries long. For each group of 10 entries, their must be a Rate slot in the 100 Hz table. Likewise, the 1 Hz table must be a multiple of 10 entries with a Rate slot for each group of 10 in the 10Hz table. Each record contains the following data in the order specified:

slot_type
cmdt_index

slot_type	Defined as follows:		
	SLOT_TYPE_NULL	0	No operation
	SLOT_TYPE_MEASURE	1	Poll measurement
	SLOT_TYPE_COMMAND	2	Output Command
	SLOT_TYPE_RATE	3	Search next lower rate table
cmdt_index	Index into the CMDT for the channel being polled. This field applies only when slot_type is SLOT_TYPE_MEASURE		

The TCID file on the hard drive will contain an ASCII decimal representation of each of these fields one record per line. Each record will be in slot type, CMDT index, bit mask order. The first line in the file will contain the number of records.

8.3.2.4.3 Discrete Measurement FDID Table

The Discrete Measurement FDID Table is a list of all discrete measurement FDID's. Each record contains a list of eight FDID's which apply to a discrete measurement channel (8 discretes per channel). The least significant bit in the channel is the first entry in the record; MSB is last. The table is arranged as follows:

{LSB_FDID, FDID, FDID, FDID, FDID, FDID, FDID, MSB_FDID}, // Channel 1
{LSB_FDID, FDID, FDID, FDID, FDID, FDID, FDID, MSB_FDID}, // Channel 2
…
{LSB_FDID, FDID, FDID, FDID, FDID, FDID, FDID, MSB_FDID}, // Channel N

The index parameter in each CMDT entry is defined for discrete measurements to be the record number in the discrete measurement FDID table as described here. Unused bit positions should have a zero entry in this table.

The TCID file on the hard drive will contain an ASCII decimal representation of each FDID with 8 decimal numbers per line (one record). Entries within a record will be arranged in the same order as the table definition (LSB first) with at least one space between entries. The first line in the file will contain the number of records.

8.3.2.4.4 Discrete Stimulus FDID Table

The Discrete Stimulus FDID Table is a list of all discrete stimulus FDID's. Each record contains a list of four FDID's which apply to a discrete stimulus channel (4 discretes per channel). The least significant bit in the channel is the first entry in the record; MSB is last. The table is arranged as follows:

{ LSB_FDID, FDID, FDID, MSB_FDID }, // Channel 1
{ LSB_FDID, FDID, FDID, MSB_FDID }, // Channel 2
…
{ LSB_FDID, FDID, FDID, MSB_FDID }, // Channel N

The index parameter in each CMDT entry is defined for discrete commands to be the record number in the discrete stimulus FDID table as described here. Unused bit positions should have a zero entry in this table.

The TCID file on the hard drive will contain an ASCII decimal representation of each FDID with 4 decimal numbers per line (one record). Entries within a record will be arranged in the same order as the table definition (LSB first) with at least one space between entries. The first line in the file will contain the number of records.

8.3.2.4.5 Engineering Unit Coefficient Table

The engineering unit conversion tables contain the coefficients for performing a fifth order polynomial conversion on analog measurements and a first order conversion for analog commands ($a_1x + a_0$). The coefficients must be derived to work with converted-count analog measurements (count is left justified within a 16 bit word). Each table entry (record) is defined by the following structure:

```
FLOAT32 a5;
FLOAT32 a4;
FLOAT32 a3;
FLOAT32 a2;
FLOAT32 a1;
FLOAT32 a0;
```

The index parameter in each CMDT entry is defined for analog measurements and commands to be the table entry (record) number within this table. Multiple CMDT entries may use the same EU table entry. Coefficients a2 through a5 are always zero (0.0) for commands.

The TCID file on the hard file will contain a 14 character text string (as in the GSE data base) for each coefficient with at least one space between coefficients. Records will appear one per line with the a5 coefficient first and the a0 coefficient last. The first line in the file will contain the number of records.

8.3.3 GSE Table Load and Initialization CSC Test Plan

8.3.3.1 Environment

A development GSE gateway will be connected to a mini-HIM which contains a defined set of I/O cards. At least one card for each of the data types supported will be present. TCID tables which support the mini-HIM configuration will be present on the GSE gateway local hard drive. Each of the tables supported will be sent. The table loads will be verified.

8.3.3.2 Test Tools

The GSE gateway will be commanded using a CCP simulator test tool developed by the gateway group. This tool is capable of generating and displaying the responses of all GSE gateway commands supported.

8.3.3.3 Test Cases

GSE Command / Measurement Data Table
Polling Rate Tables (100Hz, 10Hz and 1Hz)
Discrete Command / Measurement FDID tables

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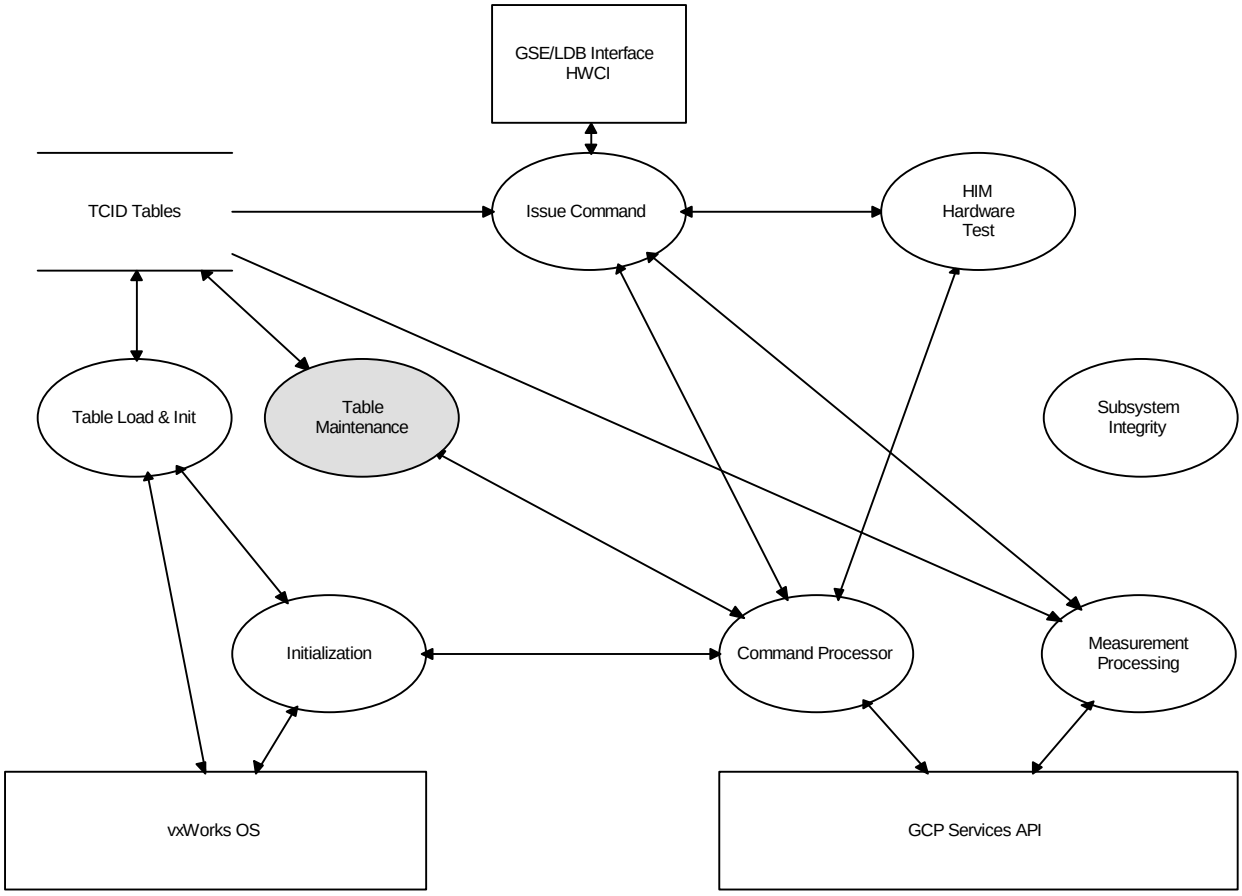
9. GSE Table Maintenance CSC

9.1 GSE Table Maintenance CSC Introduction

9.1.1 GSE Table Maintenance CSC Overview

The GSE Table Maintenance CSC is part of the GSE Gateway Services CSCI. The CSC is responsible for execution of all commands which modify the TCID tables.



9.1.2 GSE Table Maintenance CSC Operational Description

The GSE Table Maintenance CSC provides functions which are executed by the GSE Command Processor CSC in response to commands received via the RTCN. These functions manipulate indicators and other information in the TCID tables which control how data and commands are processed. The majority of these functions execute in line with the Command Processing Task. Functions which require more than minimal processing to complete will result in a message to a table maintenance task which will perform the function.

9.2 GSE Table Maintenance CSC Specifications

9.2.1 GSE Table Maintenance CSC Groundrules

None

9.2.2 GSE Table Maintenance CSC Functional Requirements

1. GSE Table Maintenance will provide the capability to return the old entry and the new entry as part of the response to all table maintenance requests.

2. GSE Table Maintenance will process requests to activate/inhibit data processing globally.

3. GSE Table Maintenance will process requests to activate/inhibit data processing on an individual measurement.

4. GSE Table Maintenance will process requests to activate/inhibit significant change processing on an analog measurement.

5. GSE Table Maintenance will process requests to read Engineering Unit Polynomial Coefficients.

6. GSE Table Maintenance will process requests to modify Engineering Unit Polynomial Coefficients.

7. GSE Table Maintenance will provide the capability to reset all inactive measurements in the MDT to active when requested by Activate Processing on all Measurements.

8. GSE Table Maintenance will process requests to activate/inhibit command issuance on an FDID.

9. GSE Table Maintenance will process requests to status command and measurement parameters.

10. GSE Table Maintenance will process requests to change the hardware address of an individual measurement or command.

11. GSE Table Maintenance will process the change hardware address command only if data acquisition is inhibited, either globally or on the requested FDID.

12. If the new HIM address in a change hardware address command is not in the HIM present table, GSE Table Maintenance will issue a HIM wake-up sequence to the new HIM and the HIM will be activated/inhibited based on the status of the wake-up sequence.

13. GSE Table Maintenance will process requests to activate/inhibit polling on an individual HIM.

14. GSE Table Maintenance will issue a HIM wake-up sequence to the HIM specified in an activate HIM polling command.

15. When the switch scan option is selected in an activate HIM polling command, GSE Table Maintenance will determine the status of all outputs for the specified HIM, update the current value in the CMDT and output a change data entry.

16. When the switch scan option is selected in an activate HIM polling command, GSE Table Maintenance will include in the response a list of those HIM outputs which did not compare with the current value in the CMDT.

17. GSE Table Maintenance will reject any activate HIM with switch scan option commands if a activate HIM with switch scan is currently in progress.

18. GSE Table Maintenance will process requests to change the sample rate on an individual measurement to either 1, 10 or 100 samples per second unless the measurement is supercommutated.

19. GSE Table Maintenance will provide the capability to detect illegal sample rate change requests.

20. GSE Table Maintenance will process requests to activate/inhibit polling on an individual measurement.

21. GSE able Maintenance will process requests to activate/inhibit HIM hardware testing on a HIM.

22. GSE Table Maintenance will process requests to activate/inhibit HIM hardware testing on an individual measurement.

23. GSE Table Maintenance will be capable of generating system messages through the Gateway Common Services CSCI using the GCP Services API.

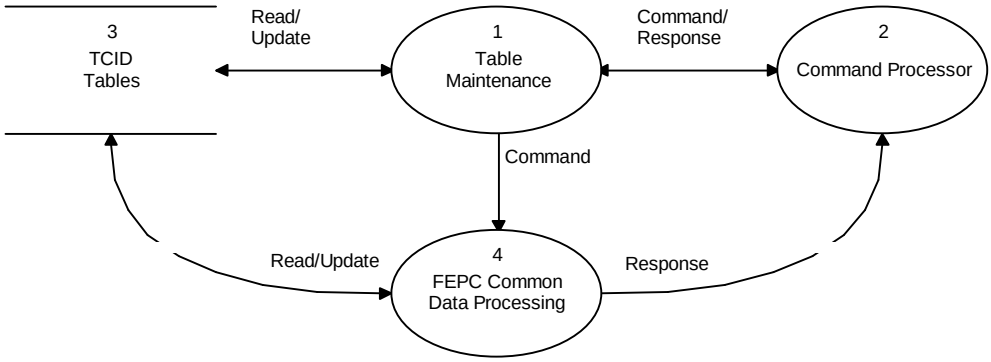
24. GSE Table Maintenance will be capable of requesting through the GCP Services API that a message be written to a file on the local hard drive or the local console port.

9.2.3 GSE Table Maintenance CSC Performance Requirements

No performance requirements have been identified for this CSC for the Thor release.

9.2.4 GSE Table Maintenance CSC Data Flow Diagram

External Data Flow Diagram



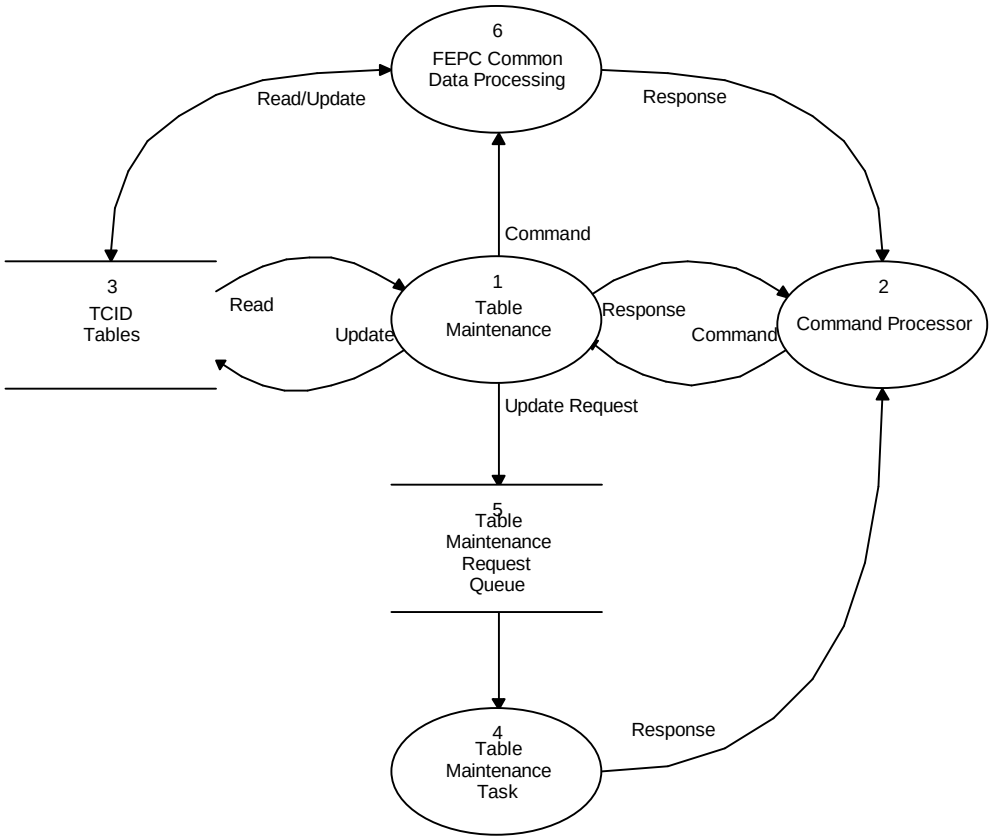
The GSE Table Maintenance CSC provides functions which are executed by the GSE Command Processor CSC in response to commands received via the RTCN. These functions manipulate processing indicators and other information in the TCID tables which control how data and commands are processed.

Some of these commands will be forwarded to the FEPC Common GSE Measurement Processing CSC which is part of the Common Gateway Services CSCI for processing.

9.3 GSE Table Maintenance CSC Design Specification

9.3.1 GSE Table Maintenance CSC Detailed Data Flow

Detailed Data Flow Diagram



The GSE Table Maintenance CSC provides functions which are executed by the GSE Command Processor CSC in response to commands received via the RTCN. These functions manipulate processing indicators and other information in the TCID tables which control how data and commands are processed.

The majority of these functions execute in line with the Command Processing Task. Functions which require more than minimal processing to complete will result in a message to a table maintenance task which will perform the function.

Some of these commands will be forwarded to the FEPC Common GSE Measurement Processing CSC which is part of the Common Gateway Services CSCI for processing. The FEPC Common GSE Measurement Processing CSC will generate the command response for those table maintenance commands it handles.

The following commands will be supported for Thor:

Route Code	Request ID	Command	CSC Function
12	4	Activate/Inhibit Command on FD	ai_fd_command()
12	5	Change Hardware Address	change_hw_address()
12	6	Activate/Inhibit FD Polling	ai_fd_polling()
12	7	Change Sample Rate	change_sample_rate()
12	8	Activate/Inhibit HIM Polling	ai_him_polling()
13	4	Activate/Inhibit FD Processing	ai_fd_processing()
13	5	Activate/Inhibit Processing All	ai_processing_all()
13	6	Read EU Polynomial	read_eup()
13	7	Activate/Inhibit Change Check on FD	ai_fd_change_check()
13	8	Activate/Inhibit Global Change Check	ai_global_change_check()
13	16	Change EU Polynomial	change_eup()

9.3.2 GSE Table Maintenance CSC External Interfaces

9.3.2.1 GSE Table Maintenance CSC System Message Formats

None

9.3.2.2 GSE Table Maintenance CSC C-to-C Communications

9.3.2.2.1 Activate/Inhibit FD Command

GSE Activate/Inhibit a Command FD (Routing Code 12, Request ID 4)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
2	0 = Inhibit commanding 1 = Activate commanding		

Response Completion Codes:

- Successful
- Invalid FDID

9.3.2.2.2 Change Hardware Address

GSE Change FD Hardware Address (Routing Code 12, Request ID 5)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
2	New HIM address	2	Old HIM Address
2	New HIM channel	2	Old HIM channel
		2	New HIM address
		2	New HIM channel

Response Completion Codes:

- Successful
- Invalid FDID
- Invalid hardware address

9.3.2.2.3 Activate/Inhibit FD Polling

GSE Activate/Inhibit Polling on a Measurement (Routing Code 12, Request ID 6)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	2	FDID
2	0 = Inhibit 1 = Activate		

Response Completion Codes:

- Successful
- Invalid FDID

9.3.2.2.4 Change Sample Rate

GSE Change Sample Rate (Routing Code 12, Request ID 7)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
2	New sample rate 0 = Return to default 1 = 100 hz 2 = 10 hz 3 = 1 hz	2	Old sample rate 1 = 100 hz 2 = 10 hz 3 = 1 hz
		2	New sample rate 1 = 100 hz 2 = 10 hz 3 = 1 hz

Response Completion Codes:

- Successful
- Invalid FDID
- Invalid sample rate
- Specified rate table is full

9.3.2.2.5 Activate/Inhibit HIM Polling

GSE Activate/Inhibit Polling on a HIM (Routing Code 12, Request ID 8)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
1	B0 0 = inhibit HIM 1 = activate HIM B1 0 = no switch scan 1 = perform switch scan	4	Number of 8-byte entries that follow
1	HIM address	4	Entry 1 - FDID
		1	Entry 1 - HIM address
		1	Entry 1 - HIM channel (card/function code)
		1	Entry 1 - Expected value
		1	Entry 1 - Actual value
		8	Entry 2
		o	o
		o	o
		o	o
		8	Final 8-byte entry

Response Completion Codes:

- Successful
- Invalid HIM

9.3.2.2.6 Activate/Inhibit FD Processing

Activate/Inhibit Processing Single (Routing Code 13, Request ID 4)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
2	0 = Inhibit 1 = Activate		

Response Completion Codes:

- Successful
- Invalid FDID

9.3.2.2.7 Activate/Inhibit Global Processing

Activate/Inhibit Processing All (Routing Code 13, Request ID 5)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
2	0 = Inhibit processing 1 = Activate processing		
2	0 = Perform immediately 1 = Perform with reset		

Response Completion Codes:

- Successful

9.3.2.2.8 Read Engineering Unit Polynomial

Read EU Polynomial (Routing Code 13, Request ID 6)

Bytes	C-C TO DESTINATION(S)
	Header
4	FDID

Bytes	RESPONSE FROM DESTINATION
	Header
4	FDID
4	A5 coefficient (FP)
4	A4 coefficient (FP)
4	A3 coefficient (FP)
4	A2 coefficient (FP)
4	A1 coefficient (FP)
4	A0 coefficient (FP)

Response Completion Codes:

- Successful
- Invalid FDID

9.3.2.2.9 Activate/Inhibit Change Check on FD

Activate/Inhibit Change Check on FD (Routing Code 13, Request ID 7)

Bytes	C-C TO DESTINATION(S)
	Header
4	FDID
2	= 0 = Inhibit = 1 = Activate

Bytes	RESPONSE FROM DESTINATION
	Header

Response Completion Codes:

- Successful
- Invalid FDID

9.3.2.2.10 Activate/Inhibit Global Change Check

Activate/Inhibit Global Change Check (Routing Code 13, Request ID 8)

Bytes	C-C TO DESTINATION(S)
	Header
2	= 0 = Inhibit = 1 = Activate

Bytes	RESPONSE FROM DESTINATION
	Header

Response Completion Codes:

- Successful

9.3.2.2.11 Change Engineering Unit Polynomial

Change EU Coefficients (Routing Code 13, Request ID 16)

Bytes	C-C TO DESTINATION(S)	Bytes	RESPONSE FROM DESTINATION
	Header		Header
4	FDID	4	FDID
4	A5 coefficient (FP)	4	Old A5 coefficient (FP)
4	A4 coefficient (FP)	4	Old A4 coefficient (FP)
4	A3 coefficient (FP)	4	Old A3 coefficient (FP)
4	A2 coefficient (FP)	4	Old A2 coefficient (FP)
4	A1 coefficient (FP)	4	Old A1 coefficient (FP)
4	A0 coefficient (FP)	4	Old A0 coefficient (FP)
		4	New A5 coefficient (FP)
		4	New A4 coefficient (FP)
		4	New A3 coefficient (FP)
		4	New A2 coefficient (FP)
		4	New A1 coefficient (FP)
		4	New A0 coefficient (FP)

Response Completion Codes:

- Successful
- Invalid FDID

9.3.2.3 GSE Table Maintenance CSC External Interface Calls

These functions are provided to the command processing CSC to be called in response to a command over the RTCN. Each function maps directly to a route code / request ID pair. The function will execute the command and generate the proper response to the RTCN.

9.3.2.3.1 Activate/Inhibit FD Command

```
void ai_fd_command (    GCPS_COMMAND_INFO_TYPE *info,
                        void *body);
```

Description: Activates or inhibits command issuance on the specified FDID.

Parameters:

info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
body	Pointer to the message body.

Returns: None

9.3.2.3.2 Change Hardware Address

void change_hw_address() (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description: Changes the hardware address of the specified FDID.

Parameters:

info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
body	Pointer to the message body.

Returns: None

9.3.2.3.3 Activate/Inhibit FD Polling

void ai_fd_polling (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description: Activates or inhibits the HIM polling of the specified FDID.

Parameters:

info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
body	Pointer to the message body.

Returns: None

9.3.2.3.4 Change Sample Rate

void change_sample_rate (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description: Changes the sample rate the specified FDID.

Parameters:

info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
body	Pointer to the message body.

Returns: None

9.3.2.3.5 Activate/Inhibit HIM Polling

void ai_him_polling (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description: Activates or inhibits polling of the specified HIM.

Parameters:

info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
body	Pointer to the message body.

Returns: None

9.3.2.3.6 Activate/Inhibit FD Processing

```
void ai_fd_processing (   GCPS_COMMAND_INFO_TYPE *info,
                          void *body);
```

Description:	Activates or inhibits data processing of the specified FDID. The FDID will continue to be polled at the HIM	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body.
Returns:	None	

9.3.2.3.7 Activate/Inhibit Global Processing

```
void ai_global_processing (   GCPS_COMMAND_INFO_TYPE *info,
                              void *body);
```

Description:	Activates or inhibits data processing globally. The HIM's will continue to be polled.	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body.
Returns:	None	

9.3.2.3.8 Read Engineering Unit Polynomial

```
void read_eup (   GCPS_COMMAND_INFO_TYPE *info,
                  void *body);
```

Description:	Reads the Engineering Unit Polynomial coefficients for the specified FDID.	
Parameters:	info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
	body	Pointer to the message body.
Returns:	None	

9.3.2.3.9 Activate/Inhibit FD Change Check

void ai_fd_change_check (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description: Activates or inhibits change checking for the specified FDID. An FDID with change checking inhibited will be output every sample.

Parameters:

info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
body	Pointer to the message body.

Returns: None

9.3.2.3.10 Activate/Inhibit Global Change Check

void ai_global_change_check (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description: Activates or inhibits change checking globally. When change checking is inhibited, all samples will be output.

Parameters:

info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
body	Pointer to the message body.

Returns: None

9.3.2.3.11 Change Engineering Unit Polynomial

void change_eup (GCPS_COMMAND_INFO_TYPE *info,
void *body);

Description: Changes the Engineering Unit Polynomial coefficients for the specified FDID..

Parameters:

info	Pointer to a GCPS_COMMAND_INFO_TYPE structure as defined by the GCP Common Services API.
body	Pointer to the message body.

Returns: None

9.3.3 GSE Table Maintenance CSC Test Plan

9.3.3.1 Environment

A development GSE gateway will be connected to a mini-HIM which contains a defined set of I/O cards. At least one card for each of the data types supported will be present. TCID tables which support the mini-HIM configuration will be present on the GSE gateway local hard drive. Each of the commands supported by the Thor delivery will be sent and the response verified. The action taken by the command will also be verified as part of the verification of the CSC to which the command belongs.

9.3.3.2 Test tools

The GSE gateway will be commanded using a CCP simulator test tool developed by the gateway group. This tool is capable of generating and displaying the responses of all GSE gateway commands supported.

9.3.3.3 Test Cases

A test case will be defined for each command processed by this CSC.